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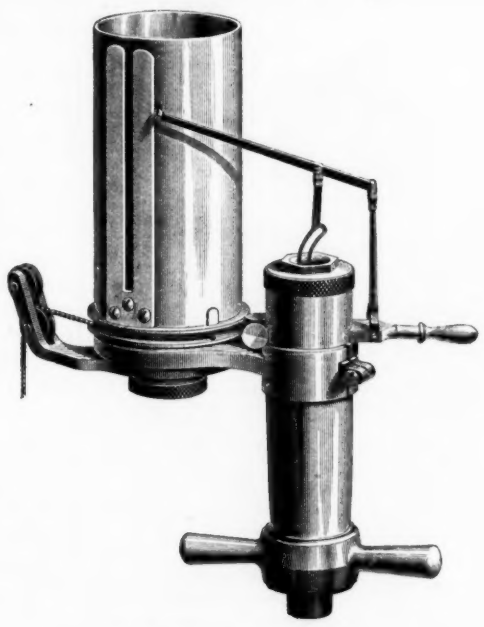
The New Steam Engine Indicator.

Our readers may have noticed, that, at sundry times within the last year, we have alluded to a new engine indicator as being prepared for the market.

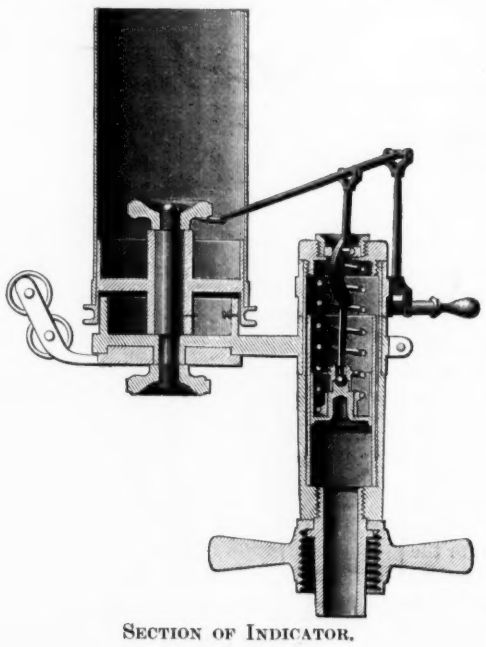
These allusions have led to such lively inquiry among such of our readers as are interested in steam work, that it is with peculiar pleasure we are enabled in this issue to lay before them complete illustrations of the new instrument, and also such description of its points of novelty as will enable them to judge of its merits.

The instrument is now in the market, and, we should judge, not prematurely, since our first brief announcement of the existence of this new instrument, the whole interval has been consumed in the construction of special machinery for the systematic manufacture of it, upon plans which are likely to insure a uniformity of excellence in construction, and, at the same time, insure an economical production.

While we are not advised as to the prices of the new instrument, we are led to believe that the purchasers will receive a full share of the benefits arising from the system of manufacture referred to. If the system of manufacture proposed, will give to purchasers an instrument of such high character as those we have seen, at a price less than is usual for indicators, we feel that we may congratulate those among our readers who are interested.

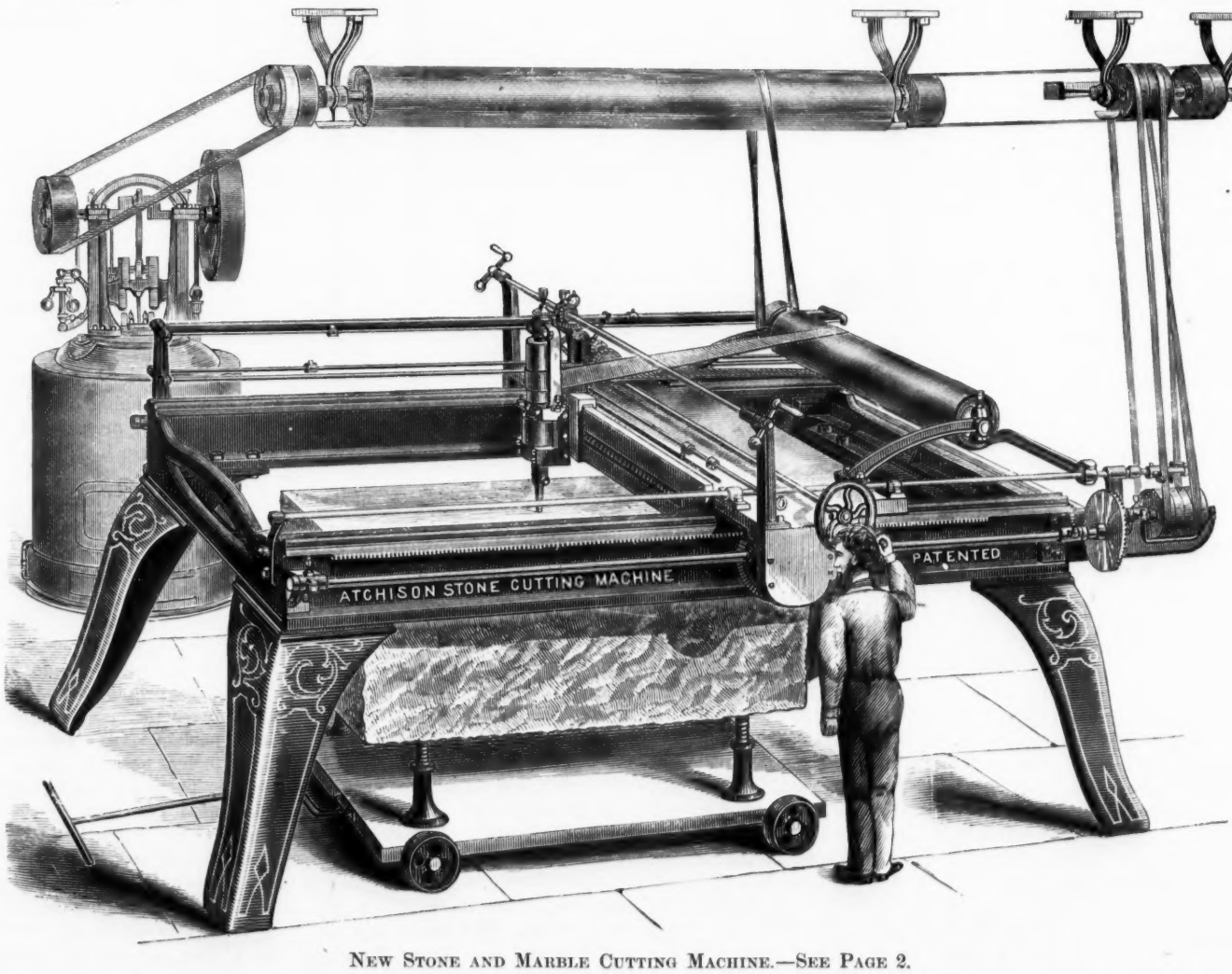


THE TABOR INDICATOR.



SECTION OF INDICATOR.

In our issue of December 20th, 1879, our correspondent, "Chordal," in reviewing the growth and modifications of indicators, briefly described, among others, the *Tabor* indicator, and ventured the prediction that it had a future. The Tabor instrument, so briefly referred to by "Chordal," is the new indicator, and the two accompanying illustrations will give a good idea of its general make up.



NEW STONE AND MARBLE CUTTING MACHINE.—SEE PAGE 2.

The most striking feature, and in fact, the main point of novelty in design, about the instrument, is the parallel motion. In describing this parallel motion, we can hardly say that it consists of few pieces, or many pieces, for in fact no pieces at all are introduced, especially to give the motion parallelism. If parallelism were not desired the same number of pieces would be required. It will be noticed that the piston rod, which is jointed to the piston and the pencil lever, as usual, is slotted. This slot is curved and works over a guide roller set in the cylinder cap. The rear end of the pencil lever is pivoted to the usual radius link.

The slot curve is that peculiar curve, which would be described by the guide roller as a scribing point, while the pencil was being moved in a true line. This it will be seen insures an *absolutely correct* parallel motion to the pencil. No moving parts are added, and those essential to the motion are peculiarly light and substantial.

The guide roller is journaled in a free collar, held in the cylinder cap. This allows all the motion work to be freely revolved as the pencil is brought to the paper. By simply unscrewing the cylinder cap, the whole motion work is removed as one piece. No small parts of the motion work need be removed, when springs are changed, or when a general interior inspection is required. This feature seems to be of peculiar value and should be appreciated by those indicator users, who have had the misfortune to lose small parts, which were necessarily removed when the indicator was opened. This feature permits the use of substantial and permanent steel screws for all the joints, as they seldom or never require separation. A section of the pencil lever would be a flat, oval; it is very light and solid. The pencil socket is arranged to fit Faber's Siberian leads. The pencil lever, piston rod, and radius link are all of steel, spring tempered. The small number of motion parts, and the lightness of those used, reduce the error due to momentum, to a point beyond which it seems impossible and unnecessary to go. The friction, which might at first be thought to exist at the guide roller, is found *not to exist*. What little friction there is, is that due to the conversion of an arcal motion into a parallel one, and this much friction is inherent in any possible device for so converting the motion.

The friction of any of these parts may be called *immaterial* in any of the well known indicators, as its amount is an inconsiderable trifle, compared with the energy of the steam acting on the piston. The momentum of the parts, however, becomes a matter of grave concern, and every effort should be made to keep it at a minimum. The piston spring (40 lbs. per inch) and parallel motion in the Richards Indicator weigh 2.875 ozs. (avoirdupois), and in the Thompson 2.125 ozs., while those of the Tabor instrument weigh 1.427 ozs. The piston, piston rod, and pencil lever together weigh only 9.655 drams or $\frac{5}{8}$ ozs.

The piston is much longer than usual. It is very light, being made of nickel casting, very much lighter in fact than the illustration shows. The piston is brought to the

exact area of one-half a square inch, and the lever multiplies the extent of motion in the usual proportion. The piston has a single capillary packing groove, and its whole action is remarkaly nice. The springs, both as to range and general structure, are similar to those in the Richards and Thompson.

The rotation of the top work is effected by a handle, as usual, but a controllable limit is put upon this motion, by means of a convenient thumb screw in the top band, bearing against a projection on the drum bracket. This screw is so located that it may be adjusted by the hand, while putting the pencil to work.

There is nothing peculiar about the structure of the cylinder, save in its peculiar external plainness. The usual form of cock, not shown in the illustration, is provided, but a change has been made in the plan of attracting the indicator to the cock. The usual compound screw coupling, on account of the difficulty of properly timing the two threads, is omitted, and a simple union nut with finger levers substituted. This nut, never being removed, serves to protect the taper and ground surface of the tail piece, which fits the socket of the cock. Upon loosening this nut it separates the joint without danger of injury to the parts.

The paper drum is made very much lighter than usual, and the paper clips are of tempered steel and quite flexible. The lower guide pulleys are self-adjusting in their line, as the bottom nut is arranged not to pinch on the swivelling piece, which holds them. The paper drum revolves upon a steel spindle, upon which the bottom nut is screwed. The nut inside the drum is simply a milled head, firmly screwed on the upper end of the spindle.

The recoil spring is seated in a cup on the bracket, and the outer end of the spring is fixed to the cup. The inner end of the spring is hooked on by the hub of the drum base. A stop-block on the cup, engaging with a lug in the drum base, forms the stop for the recoil motion. If the spindle be slacked somewhat, the drum base may be revolved over the stop-block, and more or less tension given to the recoil spring.

The whole instrument is very much lighter and more portable than any others we have seen. Its weight complete, with cock attached, is three pounds, six ounces. The Thompson indicator weighs about one pound more than this, and the Richards indicator about a pound and a half more than this. This reduction of weight, of course, becomes a matter of special value only when circumstances require hand carriage of instruments. The workmanship of the instruments is excellent, and their behavior in use is very fine. We might, perhaps, have done well to present diagrams as produced by this instrument, but we shall have occasion to do so in a future issue.

The diagrams produced are admirable. A seventy-five pound card, taken with a thirty spring, at two hundred and sixteen revolutions, and retracing its line continuously for fifty revolutions, shows a clean, sharply cut, unvarying card of the most delicate accuracy.

A seventy pound card, taken with a thirty-two spring, at three hundred and eighty-five revolutions, gives results so perfect as to almost lead to the conclusion that high speed need not interfere with accurate indicator work.

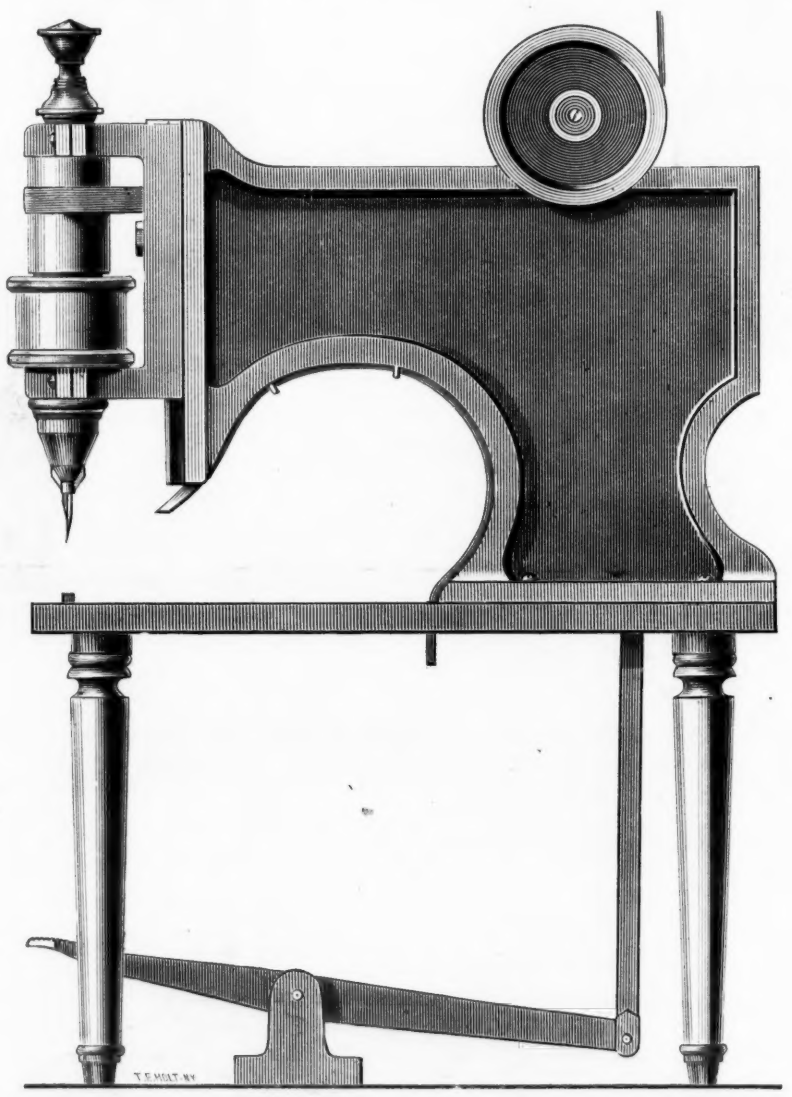
The construction of this instrument seems to open up a way for high pressure diagrams made with low tension springs, even at the highest of modern high speeds. This instrument may be used either right or left-handed, the necessary changes requiring only a few moments. The Tabor Indicator is made by the Ashcroft Manufacturing Co., 53 Sudbury St., Boston, Mass., to whom all inquiries should be addressed.

The works of Nathan & Dreyfus, manufacturers of injectors, oilers and other brass work, next building to the office of the American Machinist, were destroyed by fire, April 18th. The loss is estimated at $50,000.

Small Metal Working Machine.

New Machines for Carving and Engraving.

Our illustration on the first page represents a new design of machine designed for



Wood-Working Machine.

working stone. This machine is publicly exhibited in operation at No. 210 Fulton Street, in this city.

The machines are divided into three classes—viz., those for working metal, wood and stone. Each of these classes embody the same principles, although they are entirely different in size and appearance. The machine referred to, for working stone, is designed for dressing or planing stone surfaces. A frame is mounted upon four legs, which are extra heavy to give firmness to the machine while working. A platen or carriage is made to move along the top, sliding in V grooves. The cutting apparatus is attached to a vertical drum, and consists of a spindle divided in the center. Each of these pieces (which are called tool-holders) is provided with a steel pin, upon which is a conical-shaped steel roller. This roller moves in a grooved cam, with the largest part of the roller towards the outside.

The cam referred to is so arranged that for every revolution of the spindle each of the tool-holders receives three reciprocating motions, which in this machine is equivalent to a vertical movement of three-eighths of an inch. The reader will observe that the tools when in operation have a reciprocating, rotary motion. The running parts are all of steel. The cutting tools are made from pieces of steel shaped like a carpenter's gouge. One of these tools is attached to each of the tool-holders, and are securely held by set screws. These tools are placed with the hollow part inward; thus the two form a circle. The edge of each is made to project beyond the other, in order to produce a smoother and better surface. The velocity with the cutters revolve about 1,000 revolutions per minute, which will cause 6,000 blows from the tools. This machine will take about 1-32 of an inch at each cut from a block of granite, while it will take 1-8 of an inch from soft limestone. The faster the tools revolve the longer will they wear, and the machine is relieved from excessive wear and tear. These conditions, of course, have a certain economical limit.

The tools upon this machine are said to have stood a running test of 45 minutes, during which time the tools struck about 270,000 blows before requiring to be sharpened. To re-sharpen the tools, they are removed from the machine and fastened to a steel holder. They are then heated and driven into a hollow die, which has a hole in it corresponding to the diameter of the tools required. A steel cone is placed in the center of the hole and shapes the inside of the tools, leaving the edge about 1-32 of an inch thick and of equal length. The machine is self-acting, and all the parts are simple and well proportioned. When first introduced the working parts were considered too light. A stronger and more substantial head has been substituted, and at the present time it seems to perform its work in a very satisfactory manner. The surface of the stone is left solid and free from "stunning," which is very necessary where the work is to be afterwards polished.

As the tools are guided upon planed surfaces, a plane surface is reproduced upon the stone, which avoids the necessity of frequent tests and measurements. The wood working machine is used for cutting letters and decorations upon advertising signs and other articles of wood. The design is made up of movable metal type, and when completed is attached to the reverse side of a board. The wood to be operated upon is clamped to the opposite side. A guide pin, corresponding in size to the cutters, is located directly under the center of them. The metal form is now placed over the guide pin and the cutters adjusted to cut to the required depth. By moving the work about, so that the guide pin touches all parts of the metal form, it is reproduced upon the surface of the wood. In this manner, any number of signs or ornamental designs can be quickly produced. This machine can be applied to numerous branches of carving. A blower pipe is introduced under the cutter head, by which the chips are removed from the work. The metal working machines are, in principle, like the others, only smaller. In doing finer work, the tools must, of necessity, be made smaller. The tools used for chasing and fine matting on jewelry and metal goods, have very sharp points, similar to a needle flattened upon one side. With these machines the thinnest die work is said to be matted without indentations. It is also claimed that this machine will produce the beautiful "repousse" work, which has lately become so fashionable, specimens of which are shown in the engravings. This work was originally done by hand and was very expensive. These machines are intended to overcome the many difficulties and unnecessary expenses heretofore attending the production of hand work. The experiments now in progress will probably develop the true value of the machines.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * If I remember rightly, my last letter to you commenced and ended with that everlasting subject—machine journals.

I opened up as though I was going to tell all about journals, but before you get through with this letter, you, like myself, will conclude that there are many things Chordal don't know.

I know for certain that all journals should be as small in diameter as proper strength will permit; that the diameter of a journal has no earthly connection with its length; that plenty of bearing area will insure durability; that a certain pressure per square inch of bearing area will allow durability; that a certain greater pressure will insure immediate destruction; and that somewhere between these certain wide limits there is a pressure which is practically reasonable.

But I don't know what that pressure is, and I cannot approximate it.

* * * * I can give you some few every-day figures, and let you do your own averaging. A freight car on the Pennsylvania railroad, running out of this city, gives, when loaded, a pressure of two hundred pounds per square inch on the effective bearing of the axles.

A pillow-block on a stationary engine up town, gives one hundred and twenty-five pounds.

The driving axles of a certain Mogul locomotive bear two hundred pounds per square inch, and the crank-pin and cross-head pin of this same engine bears twelve hundred pounds per square inch.

My neighbors next door build a little eight horse threshing engine, having a crank-pin push of sixteen hundred pounds per square inch of bearing surface.

There's precious little satisfaction in such figures as these.

* * * * If the crank pin area of a locomotive was increased till the pressure got down to two hundred pounds per inch of bearing, an increase in the width of the right of way would have to be secured to let them pass, and the telegraph poles would have to be moved; and if the pressure on the driving axles was increased to sixteen hundred pounds I don't believe the engine would run a week.

Now, what's the reason a driving axle or car axle won't stand the pressure that a crank

pin will ? They are both lubricated with the same stuff—to wit: miscellaneous oils mixed with grit sucked up from the road bed.

* * * * Let us return to our experimental brick pile for further information. Assume our sliding surface at the bottom of the pile to be so small as to give some trouble. We can work it right along, but it needs care. Heavy continuous work causes it to heat, bind, and stick. If our sliding motion, instead of being steady and continuous, is a bouncing, jerky one, we can get along better. We investigate and find that though we dose the thing with lots of oil, only a trifling quantity stays to do business. This quantity is just sufficient to form a film of globules between the surfaces, just like a single layer of our buckshot.

If the pressure is continuous, the surplus oil, forced out, can't get in again, and when the little that was in gets smashed up and useless the whole thing gets dry and heated and cuts.

There's plenty of the surplus oil being around anxious to do some good, but the pressure don't let up long enough for this oil to get in between the surfaces. If our whole load is lifted every second or two, fresh oil is sucked in between the surfaces, and every thing works better. There's a sort of a slap to a crank pin bearing, and this very thing is to the benefit of the bearing. The crank pin of a passenger-engine is practically worn on one side only, but this same side is constantly shifting from one side of the brass to the other; not with a rubbing motion only, but with a total let up and shifting of the pressure on the brasses. A car axle won't do this. It's just a solid demnition grind on a shifting surface it is true, but with no let up on the pressure.

* * * * There is still more in the brick-pile. We can see how theory, as some folks call it, and practice should go together. Let us suppose that you, Mr. Editor, was the party who did the experimenting with the bearing under the pile of bricks; that you spent six months' time, five hundred dollars in money, and used up lots of good judgment and patience; that all this happened one hundred years ago; and that you write down in your little book: "A hard steel plate, sliding on a hard brass plate, lubricated with good lard oil, works well under a load of brick giving a pressure of five hundred pounds per square inch of bearing area, if the surfaces are in good shape." Let your name be Morin, and assume that in course of years your little book gets printed and accepted as an authority on such subjects.

Now then, please to imagine Mr. Wyckoff getting up a machine having a horizontal sliding surface operating under great weight. Young Tom Sackett, who calls himself an engineeer, watches Wyckoff on the job. Wyckoff's heavy load is, by a coincidence, a pile of bricks, and his good judgment tells him that a brick surface won't wear worth a cent, so he proposes to put brass and iron surfaces where the wear comes. He makes the surfaces the size of something else at the bottom of the pile. He don't "theorize" over the matter, for he is a practical man, you know.

Tom asks Wyckoff how big these surfaces are; and W. says: "They look all right." Tom says if he was building that thing he would figure on it a while and try and get it right the first time. Wyckoff says: "I don't believe any in your theories. It is simply stuff out of books. I have been thirty years at this business and I guess I ought to know how big a bearing to put under a pile of bricks." This thirty-year business is the old millwright's gag and Tom hears it often. He retorts by saying: "I know men who have been at the business sixty years, and they don't know half as much as you do, Mr. Wyckoff. I may have learned something yesterday that you never dreamed of. Your thirty-years' experience printed in a book and proven by others might save many a man a peck of trouble and anxiety some fine day." This whole discussion goes on pleasantly, and Tom has touched Wyckoff in a tender spot—the thirty-year place. He begins to wonder if, after all, this thing he has misnamed "theory" is simply a knowledge of the successful experience of other men.

Tom follows him up and says: "Now, Mr. Wyckoff, you may have those plates plenty big enough, but it's all luck if you have. Other men have done just such jobs, and they have worked with them till they were right, and there are ways of getting at the facts. You make your plates, and I will hunt up the documents and figure on the thing."

* * * * Enter Tom on Wyckoff's premises the next day with a scrap of paper. He says to Wyckoff: "I find by consulting standard authorities that a hundred years ago a Frenchman, named Morin, experimented with sliding piles of brick, at great cost of time and money, and he gives the results of his labors. I have figured on your pile of brick and find that, according to Morin, you will have to make your plates twelve times as large as you intend, or you will have lots of trouble and a total failure."

Wyckoff winces some and finally gets around the matter by telling Tom that a person so much interested in a thing had better undertake the superintendence of the job. It's a bargain and Tom takes hold.

* * * * The plates are done under Tom's directions, and after the machine starts up he watches it. It runs ten minutes, gets hot and stops. Tom wonders and figures the thing all over, and says to himself: "If these big plates heat, what in the world would Wyckoff's little plates have done?" Wyckoff says: "I don't know anything about the Frenchman Morin, and I don't know what 'coefficient' means, but I see what's the matter. These plates are so big and make so much friction that the thing can't work."

In sheer exasperation Tom ejaculates the whole of Morin's laws of friction into Wyckoff's ear and explains them, and makes Wyckoff understand. Then Wyckoff wants to know what *is* the matter.

They set a Johnny to taking the machine down and he soon comes around and says: "See 'ere lad, these 'igh spots hon this 'ere plate, shall hi take em down a bit."

Tom looks at the plates. All of the parts which really touched and made bearing would not cover a deuce of spades. He calls Wyckoff and shows him; and then triumphantly adds: "and Morin says the surfaces must be in good shape." And then the practical Wyckoff turns on this young student and says with malicious glee: "When you have worked thirty years at the machine trade may be you will know when two sliding plates are in good shape. I left this thing to you and here are the plates."

They consider this matter a "saw off," and determine that theory and practice if kept from fighting, will, when united, do anything within the power of mortal man, and they make a strong associate point by acknowledging their individual weakness.

* * * * I never expected to see the names of Wyckoff and Sackett associated so closely. Wyckoff and the elder Sackett have always been friends. They were cubs, and jours and tramps together, and now that they are in some degree competitors they are neither cordial or at loggerheads.

But young Tom Sackett considers himself a bright and shining light, and, being a gentleman of elegant leisure who likes to work, he can generally be found in the darkest and most benighted places. He naturally gravitates towards the premises of Wyckoff. Tom has good sense and is of benefit to all concerned.

* * * * I ought perhaps to tell you, Mr. Editor, that the elder Sackett is not what Wyckoff would call a "theorist." He is simply a skilled mechanic with tip top business sense. There is no science in him and he knows the value of science. He bases his whole practice, so far as originality is concerned, on the accuracy of mathematics, and he don't know a logarithm from a twinge of the lumbago. Sackett keeps men skilled in these arts and he uses them. He never puts his foot down without knowing before hand what happened to other men who have stepped on the same spot. He is no genius and can't contrive anything, but he keeps a genius and works him hard. If the sliding plate job had been done in Sackett's shop its dimensions would have been arranged with reference to how big it *ought* to be. Sackett is too wise to guess at a thing which can be determined with some degree of certainty, and too wise to use figures he don't understand. He calls himself the business manager of his concern.

* * * * Again do we return to the sliding plates. The plates were made large to increase the rubbing surface, and the chap who planed the plates sprung them so badly that they only touched in spots. The big plates thus became little plates so far as bearing was concerned, and Tom Sackett, that bright youth, supposed that a planed plate was a plane plate.

Tom will some day learn that if a bearing don't bear well, it ain't much of a bearing. He will learn that a round bearing six inches long, if some botchy lathesman turns it badly, is often only a two inch bearing.

He will learn that a six inch belt may do a certain work if it contacts nicely with a pulley, but that if some botchy lathesman scrapes a pulley up with the end of a file and leaves rings on it his six inch belt may become a three inch belt.

* * * * A round journal touches in its box, on about one-third of its circumference, the balance being free. One third of the circumference is pretty near the diameter, and it is safe, when finding the rubbing area of a journal, to multiply the diameter by the length, which gives the practical bearing surface.

* * * * If a journal is not round, the first thing it does is to commence the work of grinding itself round. In course of time the journal will get round, but it has also got smaller and looser, and the metal ground off stays around to do mischief and do cutting. A journal made perfectly round in the lathe don't have to go through this grinding operation, therefore a round journal will run nice from the start, it don't get loose and it don't lubricate itself with iron filings.

* * * * This applies to flat rubbing surfaces also. If you dont take the lumps off it will try to do so itself, and, in doing so, will groove badly and sprinkle itself with iron dust. The bearing will be in very bad shape just at the time it would be in very nice shape if the work was well done.

* * * * A badly turned journal, while it is rounding itself up, will cut rings in itself, the same as sliding surfaces cut grooves while wearing the lumps down. Badly turned journals and badly fitted flat surfaces never doctor themselves.

* * * * If two plates which rub together are found to be nice and flat, and bear practically all over, they will not work well if the file marks or any other marks run in the direction of the motion. Such marks are, in fact, little grooves which interfere with the side flow of oil, and particles of cuttings get into these grooves and act like "pins" in a file. They scratch. Surfaces having finish marks in the direction of motion are cut already when new. The same may be said of journals when round. The finish should not leave any kind of marks around a journal.

* * * * Never draw-file a piston rod or pump plunger. Finish them in the lathe with well defined encircling finish, and three days wear will give a dead polish which will stay. Never draw-file engine guides or such things. Bring them to a true surface by any process and then cross-file them lightly, even with emery paper, so as to show that there are no marks running endwise. Such guides will come to a dead, true, hard polish in a few days, and they will stay, if the surfaces are of proper size. With wrought iron, steel, or cold-rolled slides this is particularly important, as there is a vicious end grain anyhow, and cross-finish will neutralize it.

* * * * Scraped surfaces, aside from their being presumably flat, wear nicely as the endwise scratches are bound to be lacking.

* * * * A steam cylinder finished endwise would make trouble from the word go. The tool marks around a cylinder are beneficial, as indicating the absence of marks the other way.

* * * * A journal nicely rounded up and finished by lead-lapping, has little or no marking around it. A final lead lap finish given *endwise* insures the absence of other scratches, and the journal will be ready to commence its life work; not its death work.

* * * * If bad workmanship fails to take the lumps off of bearings, a substitute may be sought in a material which fills the hollows up to the level of the lumps. Metaline and sundry plumbago lubricants do this. The fine particles of this stuff flush up the surfaces and give perfect contact of self-lubricating surfaces. A bearing so outrageously fitted that no amount of oil will keep it cool will often behave itself if fitted with metaline, and no oil applied. Surfaces must be large enough for the work, but metaline corrects, in some degree, bad workmanship, and it carries its buckshot with it.

* * * * Yours Respectfully,

CHORDAL.

METAL WORKING MACHINES, WITH SPECIMENS OF WORK.—SEE PAGE 2.

The laborers employed by the Troy, N. Y., Water Commissioners went on strike for an advance from $1.25 to $1.50 a day. They say the plumbers get $1.50 and $1.75 for the same work.

The Steam Fire Engine.

BY F. G. WOODWARD.

The successful application of steam power to the fire engine is a work of quite recent date. Some thirty-five years ago a prize was offered by the Mechanics' Institute of New York for the best plan of a steam fire engine. Conditions were given as to weight, capacity, etc.

The writer, with several others (Capt. Ericsson among the rest), entered the field for the prize. There were but few plans offered—some half dozen I think. Ericsson took the prize. A brief history of this prize affair may be found in the American Repertory of Arts, which was published in New York a short time between 1840 and 1850. An illustration and description of the prize engine is given also. After this event several years elapsed ere the merits of the "fire steamer" were duly appreciated; but it has finally reached a high degree of efficiency and popularity; and were it not for the thousand-and-one useless quirks and superfluities introduced into its finished details it certainly would be a more satisfactory object for the eye to contemplate. But like every work of the human hand it is doubtless susceptible of some improvement; and to this end the accompanying plan is offered.

In the boilers used for this purpose, more or less of the surface of the steam chamber which is exposed to intense heat is unprotected by water, and the powerful forced draught and combustion which is indispensable to the efficiency of these engines, is liable, of course, to cause rapid deterioration of the parts then exposed. These boilers are also very unhandy in case of repairs, especially those with a submerged smoke box. The plan here given is free from these objections as every part of the steam chamber exposed to high heat is covered with water.

It will be noticed that it is somewhat of the locomotive type, the barrel *a* being quite short and entirely filled with tubes and water; the crown of the furnace being at *c*, and the water line at *b*, as indicated by dotted lines (Fig. 1), the steam chamber *d* being directly above the fire. The engine rests on three springs, two at *e*, the other in the socket *f*, at the center of the forward axle. The cylinder is placed in the steam chamber *d*, as shown by dotted lines Fig. 2. *V* is the valve-chest. The pump *i* is placed in line with cylinder on top of the barrel of the boiler, the pistons of both cylinder and pump being fixed to the same rod *g*. The steam cylinder only is fixed to the boiler, the pump being connected to the cylinder by a bridge piece *J*, which, with the head of the cylinder and that of the pump, is cast in one piece, the top face of the bridge serving as a guide for the cross-head *k*. The arrangement of the two equal connections *l*, cranks *m*, and fly-wheel case to the tank. The tank is not shown but it may be placed between the hind wheels and the boiler; *t* is the coal bunk and foot plate. The large wheels are held in position by the braces *o*, the slide-block *p*, and the guide-plate *r*; the block *p* being clamped to the axle and the plate *r* bolted to the boiler, the plate having a vertical slot in which the block works. The absence of all side framing and useless elaboration will serve as an offset to the slight extra weight of this style of boiler.

Builders of steam fire engines are deserving of great credit for the good proportion and workmanship usually displayed in their machines. There is no branch of mechanical engineering which demands higher skill and intelligence than that which embraces the portable steam fire engine. The machine must be light and at the same time it must be very strong. With these two conflicting conditions in hand the builder must steer with consummate tact.

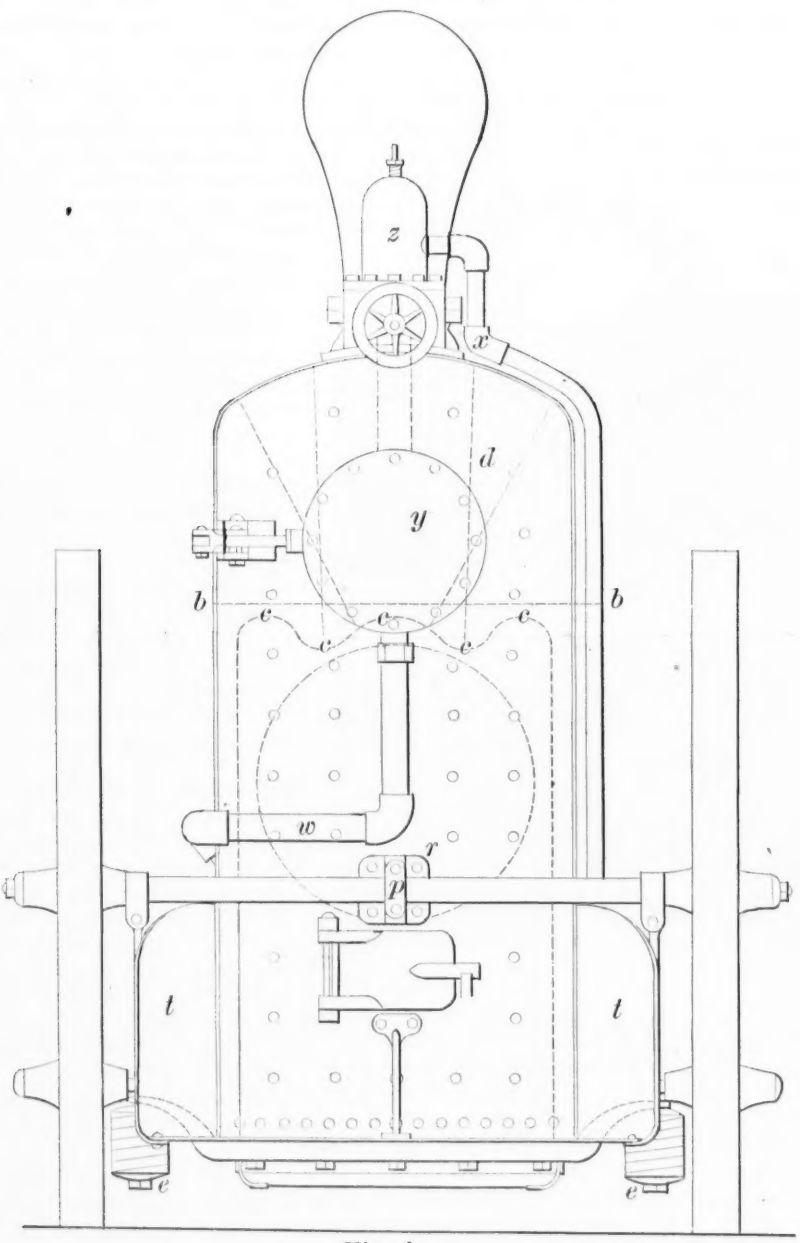


Fig. 1.

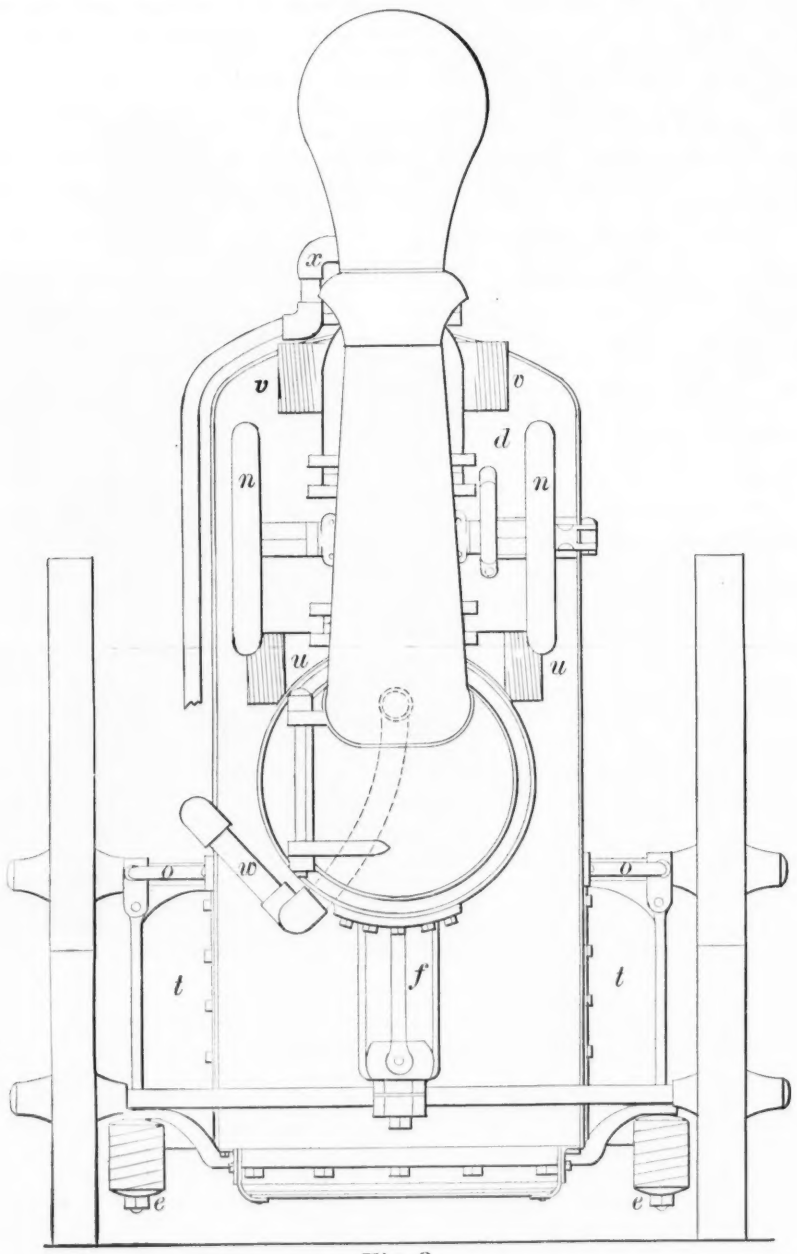


Fig. 3.

n, is clearly seen. The area of the supply valves and passages leading to the pump are much larger than usual, in order to secure a maximum supply with a minimum lift of valves. It must be borne in mind that the source of water supply is often below the level of the engine, and that the water must enter the pump with a force and velocity due to a pressure of less than fifteen pounds to a square inch, while the water must leave the pump with a force and velocity due to a pressure of three hundred pounds, more or less, to a square inch; hence the necessity of providing ample supply passages to the pump in order to ensure its highest efficiency. It will be noticed that two supply passages *u* are shown each side of the pump. This, of course, is not essential, as these passages all enter a common chamber; but two five inch hose may be more convenient than a single seven inch one; hence this arrangement. *V* are the discharge passages; *W*, the exhaust pipe leading to the tank, thence to the chimney; *x*, the scape-pipe leading from safety valve

Boiler Proportion and Construction—Water-Tube Boilers.

BY WILLIAM H. HOFFMAN.

If all the various designs of steam boilers, including failures as well as successes, that have been presented to the mechanical world for examination or trial, were to be described and illustrated in an intelligible manner, the files of the AMERICAN MACHINIST for one year would be inadequate as to space.

The first water-tube boiler, in practical form, was invented and patented by Mr. Daniel B. Martin, afterwards engineer-in-chief of the United States Navy. Mr. Martin perfected his system in 1850, but it was not generally introduced until 1856. The design was an internally fired rectangular boiler, with large furnaces having curved roofs or crown sheets, over which was a water space separating the furnace from a return combustion chamber, in which was a series of short vertical water tubes. The lower ends of these tubes were in connection with the water space above the furnace sheets, while the upper ends were open to the water and steam space above the return combustion chamber. The heat passed from the furnaces at the rear, upward, and into the combustion chamber containing the water tubes, thence returning to the front end of boiler, and then passed into the uptake leading to chimney.

The water tubes were never less than two inches in diameter, and were from 20″ to 36″ long according to size of boiler. The tubes were cleaned or scaled from the top ends, the entrance to them being through the main man hole in top of shell. Being water tubes they were set zig-zag, in order that the passing currents of heat might impinge on their outside surfaces, as much as possible, on their way to the chimney.

The water space under the lower tube sheet, and over the furnace crown, was large enough to admit of a partial cleaning on small boilers, and on large ones the scaling was effected at this point without much difficulty. But the troublesome features of these boilers were the water spaces at the sides and bottom of furnaces, these being inaccessible for cleaning, and the large, flat surfaces entering into the design of the boilers precluded a pressure above 45 lbs. per square inch with absolute safety, and even then the staying at some points was anything but perfect, or as would be so considered at the present time.

These boilers gave large evaporative duties. Several of them were constructed at the works where the writer was engaged (in 1858) that gave, on a fair test, an evaporation of 11 lbs. of water per 1 lb. of soft coal from 212°.

The first water tube boilers with horizontal or inclined tubes, put in practical shape in this country (and, I believe, the first in any country) were designed and patented by

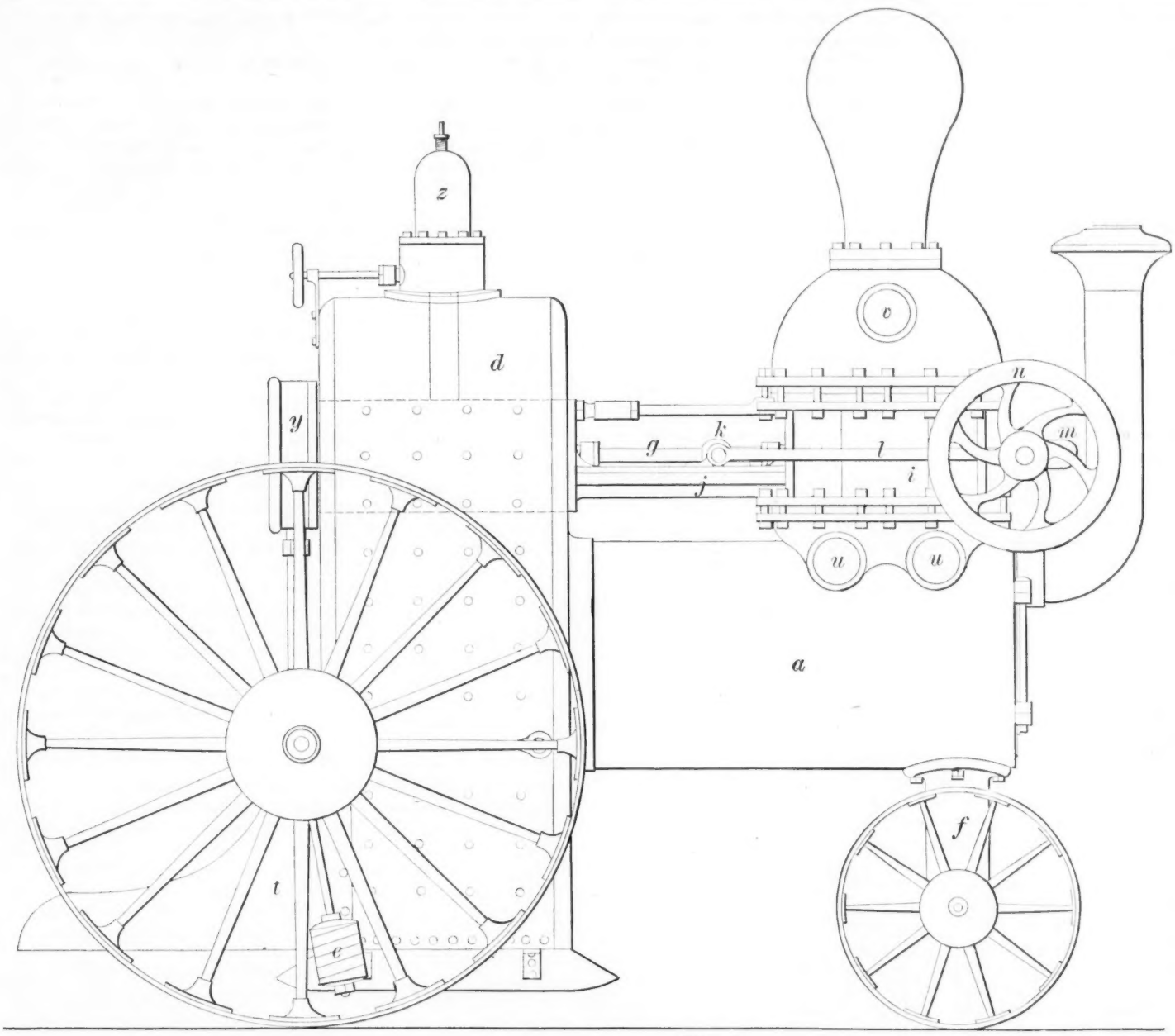


Fig. 2.

Mr. E. N. Dickerson the well known patent attorney of New York.

Mr. D. used a rectangular shell and a set of inclined water tubes directly over the grate bars; above these tubes was a crown sheet which received the lower ends of a set of vertical fire tubes. These tubes, of course, connected with the furnace passing through the water above the crown sheet, and also through the steam space above the water, this portion of them acting as superheaters. The upper ends of tubes were fastened in top of shell. The tubes were 2″ in diameter, the lower water tubes ranging from 4 to 8 feet long, and the upper or fire tubes from 18″ to 46″ long according to size of boiler.

There were bonnets at each end of water tubes, fastened to frames, riveted to shell, to allow for cleaning or scaling of the water tubes. In order to give sufficient strength to the many flat surfaces, excessive staying had to be resorted to, the result of this being that thorough cleaning in the side and end water spaces and at crown sheet was impossible.

The writer made many drawings of various sizes of these boilers, and witnessed the testing of them under different conditions. One 200 horse power boiler gave an evaporation of $11\frac{A}{10}$ lbs. of water from 212° with one pound of good anthracite coal. In this boiler there was an allowance of eight square feet of heating surface per horse power. These boilers could not be perfectly cleaned at all points where it was necessary, and they were, therefore, unsafe with bad water. With good water they would last as long as the present style of water tube boilers and would evaporate ten per cent more water with the same fuel. But there is yet another great fault with all water tube boilers that may be corrected at some future time. This fault was quite noticeable even in the Martin boiler after one or two years continuous firing. This was the burning out of the tubes at the back or out-board end of boiler, and on the sides of the tubes that received the heat first from the furnace. It is well known that the vertical fire sheets of any boiler having them, are very easily burned, as the water is readily driven from them, at even moderate furnace temperature. Now the lower side of an inclined water tube is one of the best forms of heating surface, though not equal to the concaved upper surface of a fire tube (horizontal). But I think I can demonstrate in a few articles on this subject that there are very few if any water tube boilers made at this date, that do not repel a large share of the water in the lower courses, thereby causing the tube and its end joints to burn and leak, besides forcing the water into the upper portion of the boiler or steam space, which action will certainly induce priming. Dry steam, therefore, is not as sure to be obtained from the modern water tube boiler as it is from the modern fire tube boiler.

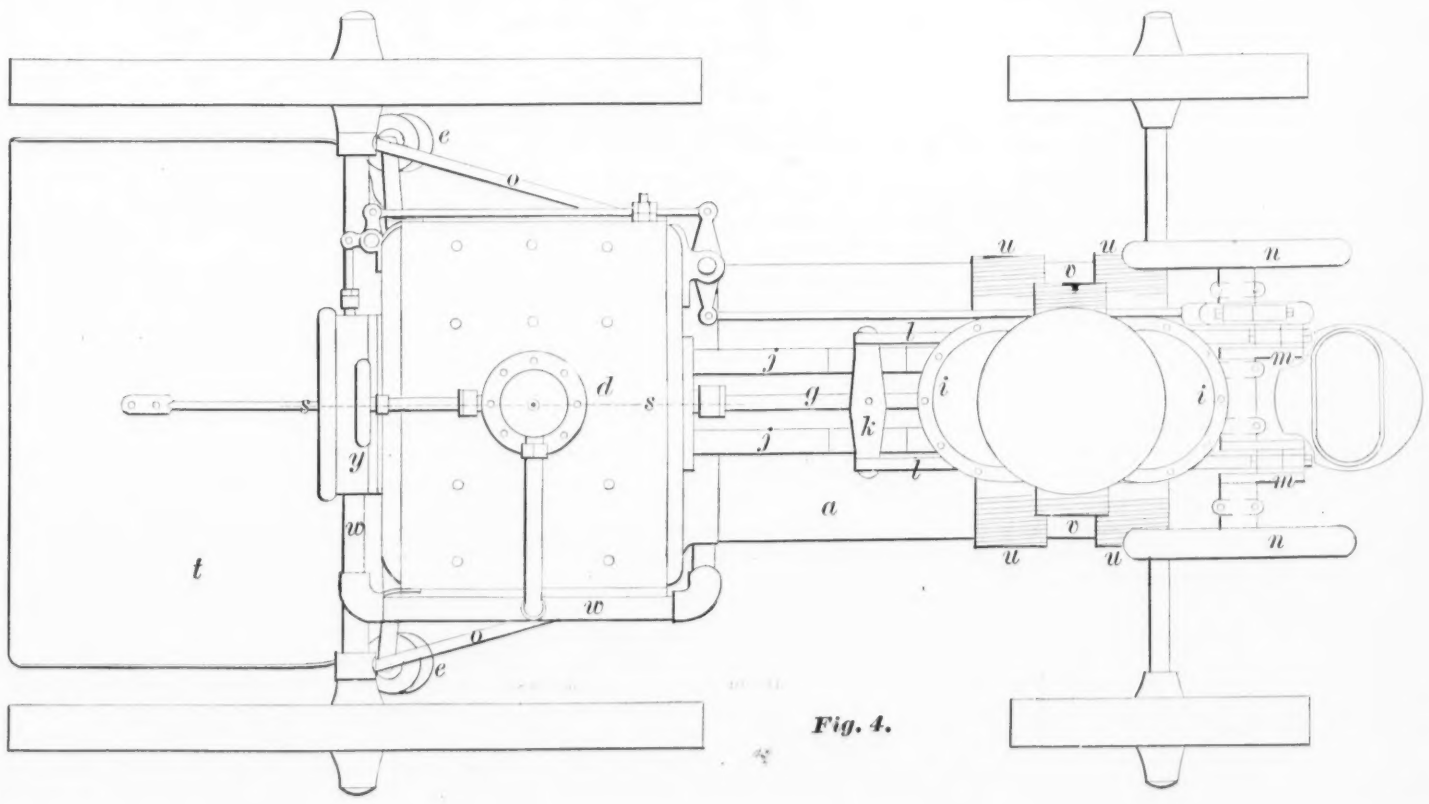


Fig. 4.

The labor market in Australia, says the *American Mail*, is slowly recovering from the long depression under which it has suffered. The building trades also show improvement. The following rate of wages is being received by the trades enumerated: Fitters, 9s. to 12s.; turners, 10s. to 13s.; boiler makers and platers, 12s. to 13s.; riveters, 9s. to 11s.; blacksmiths, 10s. to 13s.; hammermen, 7s. to 8s.; and moulders, 10s. to 12s. and 13s. per day. Tinsmiths earn from £2 to £3 per week; ironworkers from £2 10s. to £3 per week; galvanizers, £3 per week. Most of the work in this trade is done by the piece. In the engine fitting shops there is a fair supply of workmen; the wages are from 9s. to 12s. per day. The same rates are paid in the fine brass finishing shops.

A CHICAGO wholesale house, says the *Railway Age*, is having a car constructed to carry two salesmen and a stock of goods over various western railways. The car is to be sixty feet long and arranged with sleeping apartments and kitchen whereby these fortunate drummers can live in luxury, independent of country hotels and their horrors. The idea is not a new one, and it would not be strange if it became as popular as is now the plan of special sleeping and eating trains for circuses. The festive drummers would be apt to have a circus of their own at every stopping place, we imagine.

Experiments are being made in Japan to cultivate beet roots with a view to the establishment of a sugar growing industry in that country.

Iron for Fruit Trees.

The scales which fly off from iron being worked at forges, iron trimmings, filings, or other ferruginous material, if worked into the soil about fruit trees, or the more minute particles spread thinly on the lawn, mixed with the earth of flower beds or in pots, are most valuable. They are especially valuable to the peach and pear, and in fact, supply necessary ingredients to the soil. For colored flowers they heighten the bloom and increase the brilliancy of white or nearly white flowers of all the rose family.

Education of Women in Natural Sciences.

Extracts from an Address by Prof. L. C. Cooley.

Upon the occasion of the opening of a new laboratory at Vassar College, Poughkeepsie, N. Y., April 16th, Prof. L. C. Cooley, who has charge of the department of natural sciences in that institution, delivered an address from which we make the following xtracts:

Twenty years ago, when this college was founded, the sciences of nature were engaged in a fierce contest for a foothold among the agencies employed in the higher education. But that battle has been fought and science is the victor. All that need be said of the peculiar excellence of science as a means to mental discipline has been said over and over again. I shall not undertake to repeat it, but I may simply remind you of the claims which have been established by it.

It is claimed for the study of physical science in the education of the mind that it cultivates habits of careful observation, teaches method in the arrangement of facts, impresses the need of an accurate use of language, practices the power of accurate comparison, stimulates the faculty of inductive reasoning, strengthens the judgment, and quickens the imagination, and, I may add, cultivates the exercise of intellectual humility, by enabling the mind to contemplate the vast and magnificent temple of nature, whose material and architecture, in spite of all the discoveries in modern times, still so far surpasses its comprehension. Even when education is to be wholly directed to the formation of mind and character, without regard to the utilities in life, no department of human knowledge can outreach the physical sciences. That the study of physics and chemistry does, in addition to all this, impart useful knowledge, I think ought to be regarded as another element of their superiority. Considering them as subjects of post-graduate study there can be no doubt on this point, for to such study we look for the special training which prepares for professional work. And if we consider them in reference to the purely liberal education which is expected from the college course, I still think that the eminently useful character of much of the information imparted by these sciences ought not to be counted against them. For while it is true that intellectual power is better than useful knowledge, it is equally true that useful knowledge added to the mental power to use it well is better than either alone. Nevertheless, I hold that physical science is to be pursued in college for the sake of the discipline it imparts, and not for the sake of its practical applications.

In the third place, if the study of physics and chemistry is to show its peculiar excellence alongside of the study of mathematics, of literature and of philosophy, it must be pursued in the right way. It must furnish a kind of exercise which they do not, and this is possible only when it is permitted to carry the mind of the student into actual contact with material objects and physical laws.

The grievous fault in the traditional classical course is that it engages the mind solely with words and abstractions. Education for its own sake demands that this fault be corrected, for there are energies of the mind which no study of abstract truth can fully arouse, as there are phases of character which no study of nature can reach. But the attempt to correct this fault by the study of physics, pursued in the same way as the study of metaphysics, is hopeless. The study of science should be the study of nature, and it is impossible to make it such without the aid of a working laboratory. The laboratory, therefore, is as indispensable to the regular college course as it is to the purely scientific and technical courses of study.

The truth of this will be confirmed if we briefly consider the several methods which have been used in the study of science. There is first the book method. I believe that, so far as a mere knowledge of facts goes, science can be acquired from books, and that such knowledge has a very positive value. The study of the known laws of nature, of the methods by which they have been discovered, and of the evidences of their truth need not be less valuable, if pursued with the same thoroughness, and by the same methods, than the study of the laws of space or quantity, or the principles of language or of philosophy. Consider, for example, the various chemical industries without which modern civilization could not have become what it is. Every one of these processes is a conquest which the human mind has won from nature by long and toilsome struggle, and it can not be truthfully said that the history and the philosophy of these struggles have no educational value. Indeed, how can we regard the history of these struggles for dominion over the forces of nature, and the consequent exaltation of the race, with less favor than we regard the history of the struggles of men for political dominion, and the consequent exaltation or, as it may be, degradation of nations. Nevertheless, the study of nature from books alone can not exhibit the peculiar educational power of physical science. Indeed, little can be said in its favor which may not be said of mathematics and metaphysics, because the discipline is essentially of the same kind as that acquired by the study of books in these and other departments.

The study of science in books is a study about things, and not the study of things themselves. It does not bring the mind face to face with nature, but only into contact with what somebody has said about nature. One may just as well expect to reap the benefits of linguistic study by reading Pope's translation of Homer's "Iliad" and "Odyssey," as to expect the full value of the study of physics to come from reading Tyndall's elegant translations of the poems which nature has written in the phenomena of sound and heat. It is better to know Homer as measured by Pope than not to know Homer at all. And it is also better to know science as it is written in books than to be ignorant of the laws of nature. But if for educational purposes one should study the "Iliad" in its original Greek, so also for educational purposes one should study science as it is written in the phenomena of the material world.

Happily the day for the teaching of science from books is rapidly passing away. The *lecture system*, which has taken its place so largely, has many advantages. It is possible for a skillful educator, who is able and willing to hide himself behind his subject, to enable nature herself to speak through apparatus. It is possible for his pupils to comprehend the conditions embodied in apparatus, the sources of error to be avoided in the use of it, the true character of the phenomena which it shows, and the logic of the methods by which its results are interpreted. The mind, habitually guided through such processes, finally acquires the habit of dealing with facts by the scientific method in a degree which no study of books alone can impart. The phenomena are seen to be real; the reasonings are seen to be stayed at every point by physical supports, and the conclusions are seen to spring out of the solid ground of nature. If pursued by this method, physical science is able to exhibit its excellence to a considerable degree, for it is compelled to part company with mathematics, literature and philosophy, and can minister to the development of mental faculties which these departments of study touch but lightly, or fail altogether to reach.

Nevertheless, the full force of physical science cannot be secured by the lecture system. For the student, the lecture is, at best, but a translation made by another's mind. The study of the original is better discipline. For even if the pupil should sit in the presence of the most skillful translator, and should understand every step by which he embodies in elegant English the thoughts embalmed in the ancient classic, still such reading would fail to exhibit the full educational value of linguistic study. Not less is it true that, in order to reap the full benefit of the study of physical science, one must make his own translations, that the mind must be brought face to face with the original symbols in which the truths of his science are concealed.

This being true, it is clear that a college must either abandon the hope of giving the best collegiate training in this department, or else provide a laboratory for the experimental study of physics and chemistry.

* * * * *

While I appreciate the educational power of science, and have said that the value of no other department of study can surpass it, yet I am persuaded that a special scientific course is not the best for general culture. One may be an educated chemist without being in the best sense an educated man. Let him first become educated by the pursuit of a more comprehensive course, and then the technical school can make of him a better chemist than if he had studied chemistry only from the beginning.

The function of the laboratory, therefore, as far as the college student is concerned, is not to extend the course in physics and chemistry to the detriment of other branches, but rather to enable the student to pursue the physics and chemistry of the College course in the right way, with ampler facilities, with the certainty of better results, and lay a good foundation for post-graduate study for all who may wish to pursue it.

There are necessarily somewhat narrow limits to the study of these branches in the college course. The experimental study of chemistry is a slow method. To cover the same ground in the laboratory requires more time than would be required in the library. Too much must not be attempted. The lecture and the library must be brought into co-operation, and still only so much must be laid out as will permit the student to make her acquisition real and exact. A judicious selection of subjects for the laboratory course is a matter of great importance.

* * * * *

The neat manipulation, delicate touch, quick perception, and patience of woman, eminently adapt her to the study of practical chemistry. From the experience of several years in the instruction of young women, I think it may be safely said that a larger proportion of women than of men who enter the laboratory attain high standing in the elementary parts of the science to which the undergraduate study is confined. Why should they not be equally successful in the more advanced courses? If few women have won distinction in chemistry, we must remember that very few have ever attempted it. A few years have been sufficient to demonstrate her success in the college course; few more will be needed to enable woman to demonstrate her ability to pursue the higher courses into the university and out into practical life, if she chooses to make the effort. Teaching, pharmacy, medicine, and various arts and industries founded on or requiring a knowledge of chemistry, invite her to do so. This laboratory will be able to furnish the opportunity to whomever may accept the invitation.

Vassar, with its schools of art, its observatory, its museum of natural history, its library, and, we may now add, its laboratory, is competent, and I am confident that she is willing to respond to any genuine call for post-graduate instruction in art, science, literature or philosophy.

The various iron manufacturers of Philadelphia employ an aggregate of nearly 15,000 hands.

The extensive shops of the Baltimore and Ohio Railroad, at Connellsville, Pa., are to be removed to Cumberland, Md., on account of a strike of the employes for an advance of ten per cent. on wages.

The last issue of the *Railroad Gazette* has information of the laying of 964 miles of track on new railroads so far, this year, against 326 miles reported for the corresponding period in 1879, 258 in 1878, and 232 in 1877.

Letters from Practical Men.

WEIGHT OF LARGE STEEL FORGINGS.

Editor American Machinist:

I cut from your paper of Feb. 28 a paragraph in which you state that the steel shaft just shipped by the Nashua Iron and Steel Company, of Nashua, N. H., to an Ohio River steamer, is said to be the largest ever forged in the world; and you give the weight as 10,990 lbs., diameter 13″, length 28′ 6″. Mr. Krupp sent a steel shaft to Pittsburgh for the steamer Harry Brown which weighed 20,122 lbs, or nearly double the weight of the one you mention. There was one steel shaft, forged with 3 cranks and coupling flanges, at the Centennial, in Mr. Krupp's group of forgings which he exhibited which weighed 30,240 lbs. But this is a small weight beside many shafts he has made for ocean steamers. The forging for the gun barrel of the large gun Krupp had at the Centennial was more than three times this weight. The largest steel forging I have heard of was one made by Mr. Krupp, and described to me by the late James Horner, after a visit to Krupp's Works in the early part of our war. He stated this to be 30″ in diameter and 70′ long. I mention this to show that we do not as yet make very large steel forgings in this country.

Yours truly, A. H. Emery,
40 B'way, N. Y. City.

CUTTING SCREWS OF METRICAL PITCHES.

Editor American Machinist:

A screw of one centimeter pitch can readily be cut on an ordinary screw cutting engine lathe. When it is observed that the pitch of such a screw is $2\frac{54}{100}$ to the inch the exact figures being 2.540102 the error is less than the usual variation between similar screws of any pitch and therefore unimportant.

The gears are as follow, and may be compounded to reduce the size of the driver.

With 4 pitch leading screw 127×200 or $127\times100—25\times50$ intermediate.

With 5 pitch leading screw 127×250 or $127\times100—24\times60$ intermediate.

With 6 pitch leading screw 127×300 or $127\times100—25\times72$ intermediate.

The rule is to multiply the pitch of each screw by the same number. In this case 2.54 pitch is multipled by 50 $2.54\times50=127$ and $4\times50=200$. Moses G. Wilder,
Brooklyn, N. Y., April 15, 1880.

BRACING LOCOMOTIVE BOILER.

Editor American Machinist:

I fully concur in the closing sentiments expressed in Mr. W. H. Thompson's letter to the American Machinist of April 17th, on crown sheet bracing, and hope that he and others as competent will continue the discussion on this important subject.

Now I will once more try to explain the office of the thin steel suspension bars. As there is no more than $\frac{1}{18}$ of an inch difference between the expansion of the inner fire box sheets and the outside shell, as has been lately determined by *actual experiment* with a deep fire box and high shell, the problem is to provide for this variation in expansion.

Mr. Thompson seems to think that the writer claims that there will be no *tension* on the thin steel suspension bars, as they are liable to buckle. Now, what I do claim is this: The crown sheet will, by the steam pressure, be depressed to the amount of from $\frac{1}{30}$ to $\frac{1}{18}$ of an inch at the very most, and of course every tension support fastened to roof rafters will bear its full share of the total load on the crown sheet.

If these bars were *large* in section, I claim that before half the full steam pressure is reached, the expansion of these large, *stiff* braces would depress the crown sheet, it forming, as Mr. Thompson very truly says, a strut between crown and upper roof sheets. So then, with the thin braces, the crown sheet will be depressed in ordinary cases much less than $\frac{1}{30}$ of an inch at the *center*. Question (which I will not answer at this writing): Will the crown sheet be injured by this action, and will it *ever fall* by *any* legitimate pressure?

Now let us consider the crown bars as supports, without any suspension braces or bars attached to roof for supporting them. We will suppose the fire box to be 3 feet by 5½ feet inside, which of course is the size of the crown sheet, and the steam pressure at 150 lbs. per square inch. The total load on the crown sheet will be 356,400 lbs. We will call the sides of fire box 5 feet deep, not perpendicular, by any means, but *curved* inward by necessity; half the way down, some 4 or 5 inches, these sides may be $\frac{7}{16}$" thick, stayed every 4½ inches to outside shell.

I believe Mr. Thompson admits that the two or three upper rows of stay bolts *often* break after a certain period of use, owing, of course, to the expansion of the side fire sheet. Suppose the crown sheet is supported by *ten* crown bars, then each of these must support 35,000 lbs., as we will not take the crown sheet or the end sheets into account, then the whole load is, according to Mr. Thompson's plan, resting on the two side sheets, which are held in position by the stay bolts connecting them with the outside sheet; of course these side sheets must carry 178 tons, assisted slightly by the tube head and front sheet. Mr. Editor, after due consideration, I will take my chances with the boiler whose crown sheet is supported by the thin steel braces fastened to the T iron rafters, riveted to roof of outside shell. Yet I am still open to conviction to the contrary by any fair argument.

Passaic, N. J. WM. H. HOFFMAN.

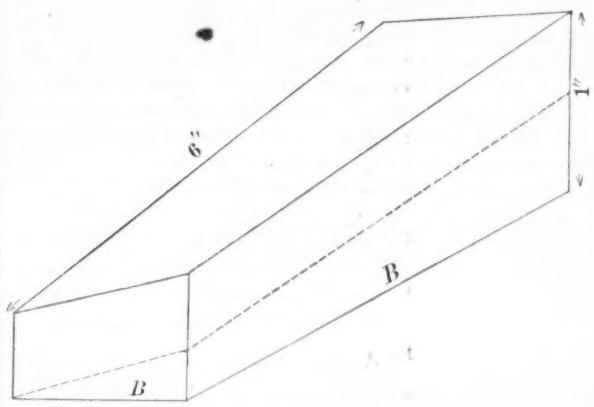
Necessity for Skilled Handwork.

We take the following from an address on "Machinists' Handwork," delivered before the Spring Garden Institute, of Philadelphia, by Joshua Rose, M. E.:

"In showing you, as far as I am able, some of the necessities for, and the advantages and possibilities of hand labor, I would not be understood as advancing that good and excellent work cannot be executed exclusively by machine tools and special machines. Indeed, in the absence of a corps of expert machinists, especially taught the skillful use of hand tools, hand labor cannot produce in quantities work equal in quality to that produced by well constructed special machine tools. But when it comes to be a question of the most expert workman against the best of machine tools in a race for quality, the machine tool cannot hold its own. This remark, however, applies with greater force as the size of the work increases; thus in watches, sewing machines, etc., hand labor could excel but little in the quality of a single machine, and, in a number of machines, this advantage would be much more than overcome, in that the special machine work would interchange, whereas the hand work would not, without, indeed, an unprecedented refinement of workmanship. Such a point of refinement is, however, among the possibilities, for there is nothing that tools can accomplish that cannot be done by hand tools. The hands are willing and obedient slaves to the brain, and can accomplish anything in the way of work that the brain can direct.

"Here let me say that I do not believe that skillful hand labor is a thing of the past, but rather that the achievements of our eminent engineers and machinists have obscured it. The Sellers, the Brown & Sharpes, the Pratt & Whitneys, of our time, have placed it in a minority because of their wonderful productions, which have lessened the demand for it. This is in every way desirable, for we have not one single machine tool or special machine too many, nor, indeed, have we enough. At the same time, however, skillful hand labor is, and always must be, a positive necessity, because of repair work; for, though, under the gauge and interchangeable system of manufacture, a new piece may at any time be furnished, yet, in most cases, a new piece will not answer to perfection. Suppose a bolt to have worn too small, then the hole into which it fitted will have worn too large, and the original size is a thing of the past; and though the manufacturer may send a new bolt, he must send also a new hole to make the job a proper fit. Again, in the general workshop and repair shop, there is a great deal of work that with skillful hand labor can be done absolutely quicker, as well as better, by hand.

"The accompanying illustration is a piece of cast iron which your committee has sent to a machine shop and had planed. It was originally square in cross section, and if I chip and file it parallel again, I shall cut off exactly the same amount of metal that was planed off. The committee inform me that the time taken to plane it was one hour and ten minutes, and if you will excuse me for taking off my coat, I will see how long it will take me to chip and file it parallel again, that is, down to the dotted line from the side *B*."



Here the lecturer commenced the work, but the surface of the metal was somewhat chilled, so that the chisel edges doubled and bent; a second chisel broke, others were furnished, but they became blunted and jagged after a few blows. The heaviest part of the metal was finally roughly removed, however, and he proceeded with the rough file, finishing by draw-filing with a dead-smooth file. Upon completing the work, he continued:

"The job is done, and your chairman announces that I have taken 35 minutes, but with ordinary iron (or had the iron on the surface been soft, as the planed surface is), I can do the same work in a good deal less than half the time that this has taken me. The surface, you see, is true and smooth, free from scratches or file marks, except from the dead-smooth file. Here, however, is another job, a badly leaking (as you see) stop cock. This I will file to a water-tight fit, without grinding it."

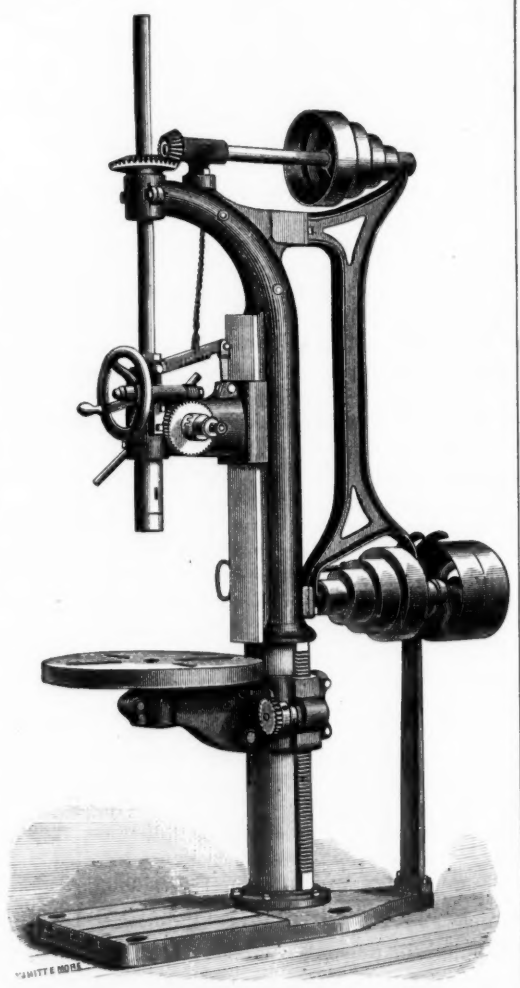
This the lecturer proceeded to do, accomplishing it in eight minutes, the plug being an inch in diameter at the largest end, and 3½ inches long. He then proceeded:

"Now, as the evening is so far advanced (past 10 o'clock), there is not time to file up the planed and milled surfaces which your committee have provided, for me to show the necessity for the file, in many cases, as a correcting agent; but I will place them upon a true surface-plate, and thus test their truth.

This is a milled surface of 6×4 inches, and as I stroke it with my hands upon the corners, you will distinctly hear a click upon two opposite corners, showing the milled surface to be atwist and to need correcting with a file. Here, again, is a planed surface, about 8×6, which, as it touches on the corners, is hollow. Now, here are some filed surfaces, which I place together, and, as you observe, one will lift the other by reason of the exclusion of the air between the surfaces. Here is a piece of steel, 1½ inches square, filed only on one surface, and here, you observe, it will, from a partial vacuum between the surfaces, lift the bottom plate, which measures 8×12 inches, and weighs 23 lbs. Now, placing a completely finished filed surface, 12×8 inches, and one filed nearly, but not quite, to a finished surface, together, and applying a loop of string and a spring balance (the surfaces being as dry as they become by well wiping them with a dry, clean linen rag, after one drop of oil has been distributed over the two surfaces), the spring-balance shows that it takes 23 lbs to slide one plate on the other. I will now add two drops more oil to each plate, thus, and, as you see, it now takes 45 lbs. to slide one plate over the other. Thus it appears that the practical effect of applying oil is not always that of reducing friction, a fact which, I think, our accepted laws of friction omit to mention or take into account. I may add, that after a cast iron surface of this size, 12×8 inches, has been very carefully planed, it takes several hours hard filing with a 14 inch smooth and dead-smooth file to true it up as these are trued. It is an easy task to perform, the only difficulty being that the warmth of the hands, when trying the plates together, expands and warps them so, that I am obliged to let them stand occasionally to cool. As an example, I place this piece of cast steel, 1½ inches squares and 9 inches long, upon the surface plate, and set it in motion by touching its end thus, and it rotates upon its center, as you see. I place my hand upon it about ten seconds only, and touch it at the end as before, and now it does not touch at the center, but swings (you observe) from the end, as though it was pivoted there. Professor Holman, of the Franklin Institute, will now with his megascope show you these machines and hand-finished surfaces on the screen."

This the professor proceeded to do, the lecturer explaining as follows:

"This shows the planed surface. The broad lines are the tool feed marks, and the dark spots are small depressions in the metal, which have been broken out by the cutting tool, as is very often the case with planed work. * * * The professor has now reflected the surface I chipped and filed this evening. The fine faint lines are the dead-smooth file marks. * * * The surface now shown upon the screen is the one that has been surfaced in a milling machine. The shadows you perceive are the sides of small projections which cover the surface and end in a greater degree as the area of a milled surface is increased."



NEW 22" DRILL.

New Drill Press.

From the many new designs of drill presses which have been placed before our readers it would seem that all the ground for improvement had been fully covered. Yet the machine which is represented by our illustration on this page possesses a number of new features which recommend it to our careful consideration. This machine is composed of a hollow upright column which is firmly attached to the bed plate. This column is braced by a smaller column which greatly increases the stiffness of the main column. The usual device for raising and lowering the table is placed at the side for convenience. The principal new feature is the device for a combination-counterbalance of the sliding head and spindle. A connecting link, having a jaw, has one end connected with a collar upon the spindle, while the other end is attached by another link to the sliding head. The counterbalance weight is suspended within the main column.

It is connected by a chain to the link first referred to, and by changing the link upon the end of the chain into the different notches, shown. The effect of the counterbalance weight may be varied to suit the operator. The effect of the weight upon the sliding-head alone always remains the same. It has a steel spindle, furnished with a raw hide bearing, to prevent the usual difficulties from cutting of the parts. The sleeve, through which the spindle passes, is provided with a slit, and may be tightened by a set screw to hold the spindle in any position, also to take up any lost motion. The gears are cut and run very quietly. This press is furnished with or without self-feeding attachment also with or without back gears.

A very simple and effective "quick return" motion is attached to the spindle. The machine shown will admit a piece of work 22" in diameter. Several other sizes are manufactured. The reader will observe that these presses may be completely taken apart and securely packed in boxes occupying the least space, which is a great advantage in shipping long distances. The workmanship is excellent and the parts well proportioned. These presses are being introduced by E. P. Bullard, No. 14 Dey St., New York.

The old Shiffler Engine-house, on Moyamensing avenue, says the Philadelphia *Trade Journal*, below Dickerson street, erected at a cost of over $20,000, and vacated when the Paid Fire Department came into existence, has been purchased by New York parties for $4,000. The firm will turn the place into a comb manufactory, and remodel it to suit their business.

The Philadelphia and Bound Brook railroad has had a locomotive built that will make the ninety miles between New York and Philadelphia in ninety minutes, and, if it is a success, the road will be supplied with other engines of the same make. The new engine has probably a larger pair of driving-wheels than any passenger engine on the continent, the diameter being 6½ feet, while the driving-wheels of ordinary passenger engines is from 5 to 5½ feet. It has only one pair of driving-wheels, without the other additional smaller wheels that other engines have. It is much heavier, too, its weight being 84,000 pounds, while the weight of most engines is from 70,000 to 75,000 pounds. It will not stop between the two cities, even to take water, for it is supplied with a tank of double the usual capacity, which will hold 4,000 gallons.

JAMES MOORE has worked for R. D. Wood & Co., of Milvillle, N. J., for eight years, and has had in that time only $2.50 in cash, the balance of his wages having been paid in store orders. It is superfluous to add that James is no richer than he was eight years ago.

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PUBLISHED WEEKLY

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers who fail to receive their paper promptly will please notify us at once.*

☞ Entered at the Post Office at New York, N. Y., as second class mail matter.

NEW YORK, MAY 8, 1880.

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Prices and Demand for Machinery and Tools.

Less than one year ago a state of dullness prevailed in most machine shops, large and small, throughout the country. It was rare to find a shop of any considerable capacity supplied with orders to its full ability to execute. Although work was more plentiful than in the most severe times of depression, much of it was done at bare cost, and in many instances below cost. Railroads had become accustomed to order supplies only to serve their most pressing necessities, and it was the almost universal belief that many years must elapse before all the locomotive works, and the machine tools establishments, would be pressed with orders to the extent of their full manufacturing capacity. But the change within one year has been so remarkable and unforeseen as to upset all the calculations of veteran political and industrial economists.

Although it is a well-known fact that advances in market prices and the volume of trade are much more rapid than the decline of the same, it was generally thought that after so long a period of industrial depression, the process of recuperation would be unusually slow. That it has been otherwise is an additional proof that hopefulness and confidence in the happy issue of business affairs are peculiar traits of American enterprise; that the real influence of chronic croakers is very limited.

The rapid recovery of our depressed manufacturing interests is altogether beyond anything of the kind in Europe, with the possible exception of France after her war with Germany. The present condition of our machinery industries is in every way gratifying. The number of men employed is far greater than it was one year ago, and not a few shops are running night and day. Those desirous of buying machine tools are, in many cases, obliged to wait from two to four months to get their orders filled. This fact has much to do with delays in filling orders for other classes of machinery, such, for instance, as mining machinery, cotton, woolen and silk machinery, steam engines, wood working machinery, locomotives, and a wide variety of special machines, all of which are now in unusually good demand.

Prices of machinery and tools have been slower to advance than has the demand. The consequence is that no weakness has been developed in regular asking prices, while iron has declined fully twenty-five per cent. The wages of machinists have also advanced slowly—not so rapidly as in some other trades—but the advance is well sustained, and the tendency is still upward. Iron workers whose wages are based upon the selling rates of iron have been obliged to accept a reduction. It is not likely that there will soon be any decline in the general prices of machinery. On the contrary, prices are inclined to advance, and good commercial reasons exist for anticipating higher prices next fall than those now ruling.

Change in Edison's Electric Lighting System.

We have stated that we hoped soon to publish the report of an indicator test made of the engine in use by Mr. Edison at Menlo Park in his electric lighting experiments. The test has been made and the report is in type, but upon consultation with the engineers making it, we have decided to withhold its publication until the complete test can be made, which we purpose making whenever lights enough are in operation to make the report authoritative. As Mr. Edison has substituted a fibre loop for the paper loop formerly used, materially affecting the essential points of resistance, power and durability, it is believed that publication of results at this time would be unfair both to the public and to the Edison lighting system. We have been afforded the fullest opportunities that could be desired for making such a test, and have seen no indications, upon Mr. Edison's part, of a desire to cover up anything at any time.

Demand for Good Machinists.

The demand for good machinists still continues. Doubtless, many employers are obliged to be content with poor ones; but, except in cases where illiberal employers want good men at the wages of poor ones, the man who thinks while he works, and works while he thinks, is most likely to obtain and keep the desirable positions. Several advertisements on pages 9 and 10 show good machinists where the demand comes from this week.

Melbourne Exhibition Prospects.

The applications for space to exhibit at the internatioual exhibition at Melbourne, which opens October 1st, are already sufficient to warrant the belief that there will be from 300 to 350 exhibitors from the United States. The original space assigned to this country, 30,000 square feet, has lately been increased to 50,000 square feet, and a creditable display of American productions seems to be assured. Mr. T. R. Pickering, the United States Government agent, whose office is room 2, Post Office building, New York City, informs us that a short time yet remains for receiving additional applications for space. Among the articles desired to complete the representation from our country are wood-working machines, locomotives, machines for drawing and stamping sheet metals, turbine waterwheels and mining machinery. The aim of Mr. Pickering has been to hold out no inducements to exhibit goods that are not likely to be sold to advantage in Australia. The last sailing vessel, in time to ship goods for the opening, leaves New York June 1st, and all goods after that date must be sent by steamer, which requires 28 days from San Francisco. Steamers leave London the 7th and the 21st of July, the former due at Melbourne September 8th, and the latter August 25th. The cost of shipping goods from New York to the exhibition building, including wharfage and cartage to destination, is 22½ cents per cubic feet. It is to be hoped that our machinery manufacturers will take advantage of this exhibition to introduce their productions into Australia where British machinery finds a good market.

A Laboratory for Women.

There are those who profess to see no desirability for the scientific education of women, as though an acquaintance with the use ful arts were a special prerogative of the masculine portion of enlightened communities. Narrow views of this kind are entertained, even in the face of abundant facts, showing that, with equal opportunities, women attain, equally with men, familiarity with the properties and laws of matter and material forces. That they are not always called upon to use this knowledge in the same way as men, should be no argument against its value in their possession. Although women are not expected to conduct analytical laboratories or manufacturing establishments, or to become mechanical engineers, yet they often have large influence with the men who control operations of such a character. It is not infrequently the case that women are valuable advisers in their husband's business affairs. The possession of scientific knowledge often qualifies them to render timely assistance. The man who is inclined to spend his time and money in a wild goose chase after perpetual motion, or in developing a rotary engine, or some impracticable machine, may have his folly plainly pointed out to him and be restrained by his scientific better half. For commercial, as well as for other reasons, the desirability of a scientific education for women is becoming widely recognized.

But the facilities for obtaining such an education are limited. Until the founding of Vassar Female College about fifteen years ago, no institution existed where females could obtain the same advantages for a collegiate course as those afforded to males. The great success of that institution has opened the doors of other colleges to women both in America and Europe.

A few days ago a well-planned building was opened at Vassar College, thoroughly furnished as a chemical and physical laboratory for the instruction of young women. We had the pleasure of being present at the opening, and of listening to an excellent address by Prof. Le Roy C. Cooley, who for more than ten years has had charge of the department of natural sciences in that institution. A portion of that address will be found in another part of this paper. The building which is one of the most complete of its kind in this country was erected, and presented to the college, by Vassar Brothers. Its cost, including the apparatus and furniture, was over $20,000. It is possible in this laboratory to accommodate one hundred students, each having an independent set of apparatus for her exclusive use. This is the first laboratory ever erected for the instruction of women; and as it is to be in charge of Prof. Cooley, one of the most thorough teachers of natural science, and author of a valuable series of text books on philosophy and chemistry, there is every reason to believe the result will be in the highest degree creditable to scientific progress.

Two Suggestive Announcements.

A lively Western journal, *The Railroader*, published in the interest of railway employes, prints two announcements, side by side, upon one of its pages, which are, to say the least, suggestive. Artificial legs and arms, including "the celebrated anatomical leg, with universal ankle motion," are brought to the notice of the cheerful train man by the enterprising manufacturer, in a manner not calculated to soothe the nerves of that athletic functionary. In an adjoining column, a number of *births* are recorded, as having occurred in the families of train men, doubtless with the view to supply the gaps made in the service by accidents and smash-ups.

The Average Mechanic and Education.

Why is it that the majority of mechanics are so much opposed to securing a technical education, and why do they dislike those of their number who may have been fortunate enough to avail themselves of the benefits of such knowledge? These have been, and are still, problems which we have been able to solve only in part. Men may be found in nearly every shop who consider practice all that is necessary, and there are plenty of men who will maintain that an engine may be designed without the use of scientific knowledge. We have in mind such a man, who once made a wager that he could substantiate the foregoing assertion in practice. His wager was accepted, and he began by drawing the boiler and frame of a locomotive. After proceeding for a few moments, he was interrupted by his friend (who had accepted the wager), who asked him what he was about. The reply was that he was carrying out his assertion. This was objected to, upon the ground that the more simple problems in geometry were being used, besides certain calculations which were some of the rudiments of a technical education, and were explained. The man who had been so sanguine but a few moments before, dropped his head, and the truth began to dawn upon him that he had been ignorantly using problems and calculations which, notwithstanding he had learned them from men in the shop, were, in reality, portions of a scientific education. After being cornered, and the effects of being fairly beaten began to pass away, his countenance suddenly brightened as he said: "Well, this is but one instance; you cannot instruct a man in setting valves by the use of books." We named certain articles which were published in the AMERICAN MACHINIST, stating that a number of men who were uninstructed in setting valves, had procured these articles and followed the printed directions in detail. Their testimony is that they succeeded admirably, and their work was accepted. When we left our friend, he was looking at the ground and scratching his head as he gave vent to the expression: "Well, well, I thought that I knew something."

A short time since a certain mechanic saw some engine diagrams, which were published in a certain paper. He suddenly conceived the idea that he would like to know how to work up the results. Accordingly he applied to an engineer who was posted in that line of business, and asked him if he could tell him how to lay out the adiabatic, or theoretical curve. "Most certainly," answered the good-natured engineer. "How long will it take?" eagerly asked the mechanic. "Only a few minutes," answered the engineer. "Oh, by the way, I have left my reference book, containing tables of logarithms at home, so it will take a few moments longer as I will have to work them out." "Logarithms," exclaims the mechanic. "What the d—l are logarithms?" The engineer then attempted to explain the nature and use of logarithms in abridging mathematical calculations. Our friend the mechanic looked on very deeply interested at first, but pretty soon the expression upon his face changed to a serious, then to a surprised indignation as he broke out: "There, that will do, I guess I don't want to learn any more about diagrams. I haven't time to-day. I'll see you again," and in a moment he was gone.

These incidents are but illustrations of the condition of thousands of the best practical mechanics in this country to-day, who have a sort of prejudice against scientific investigation, and yet do not consider that if the opportunity and means were offered them to go into business they would inevitably fail (like many with whom we are acquainted) for the lack of the business knowledge which is necessary in order to make estimates and take contracts. The mechanic at the present day should lose no time in securing a good education. Age is no argument against this recommendation, as the best and brightest men have secured their knowledge at an advanced age. A man to be a perfect success should make up his mind to be at study the rest of his life, as the more knowledge a man acquires the more eager will he be to advance. We advise the mechanic to *aim high*, to consider himself a little more than a "greasy mechanic," and entitled to move in the best society. Let him extend his acquaintances among influential men. Good, capable men are always wanted, and if there is only *one* in a hundred who can become qualified to take charge of work, it should be a noble ambition for a mechanic to consider himself that *one*, and strive to attain that distinction.

Business Specials.

40 cts. a line for each insertion under this head.

A "New Pulsometer;" has no mechanical arrangement to absorb power; simple and economical. "Have had in constant use a No. 7 Pulsometer for over three years; it has given entire satisfaction. With the exception of a little wear on the valves, is as good as when purchased. Would most cheerfully recommend the Pulsometer to any one who may want a pump, as it will do just what it is represented to do. Commercial Manufacturing Company, 643 West 48th Street. John D. Peck, Superintendent." Office of Pulsometer, 40 John Street, New York.

H. R. Worthington, 239 Broadway, N. Y., has lately issued an enlarged circular of Worthington Steam Pumps. It will be noticed that the prices are the same as in the last list, being lower than those of any other steam pump in the market.

Improved Work Holder for Lathes, Gear Cutting Attachment for Lathes, Tyson Vase Engine 1-32 Horse Power, New Tools, Chucks, Drills, Lathes. Send for 1880 Catalogue. Jackson & Tyler, Baltimore.

Patent For Sale.—Or right to manufacture and sell on royalty, an attachment to steam-engine governors to prevent racing, or stop engine from a distance in case of accident. Now in successful operation. For particulars apply to Robert Jackson, 216 Broadway, N. Y.

All kinds machine drawings. Inventors' work a specialty. Hours, 9 to 6. Wm. D. Skidmore, No. 733 Broadway, N. Y.

W. F. & John Barnes, Rockford, Ill., manufacturers of machinery, want a few more machinists.

For Schaffer & Budenberg's celebrated Steam Pressure, Hydraulic and Vacuum Gauges, Engine Counters, Pyrometers, Thermometers, Reducing Valves, Superior Crystal Gauge Glasses, etc., address W. Heuermann, 40 John Street, New York.

American Watch Tool Co., Waltham, Mass., Whitcomb Watch Makers' Lathe, and Watch, Watch Cases and Clock Making Machinery.

See Standard Turbine Adver' in next number.

James W. See, Consulting Engineer, Hamilton, Ohio.

Wilkinson & Crowell, 1201 Beach St., Philadelphia, make an Improved Metallic Piston Rod Packing, which is entirely automatic and of great durability. Works well at high or low pressure, and can be used in common stuffing box, or without any stuffing box at all.

Norris & Rutter, Mechanical Draughtsmen and Patent Solicitors, 424 Walnut Street, Philadelphia.

A new automatic valve gear for steam engines complete. Address, Ed. F. Williams, P. O. Box 148, Leadville, Colorado.

Dies for every purpose. Stiles & Parker Press Co., Middletown, Conn.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, 65 Henry Street, Brooklyn N. Y.

Car Builders' Dictionary. Now ready. Assigns names to kinds and parts of railroad cars, identifying each. 800 engravings, and 490 pages. Price, postage prepaid, $2. Ten copies to one address, $17.50. Published by the *Railroad Gazette*, 73 Broadway, New York.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

To Manufacturers and others: We are prepared to build all kinds of machinery. Patent Articles a Specialty. Correspondence Invited. Mather & Newitt, Practical Machinists, Leominster, Mass.

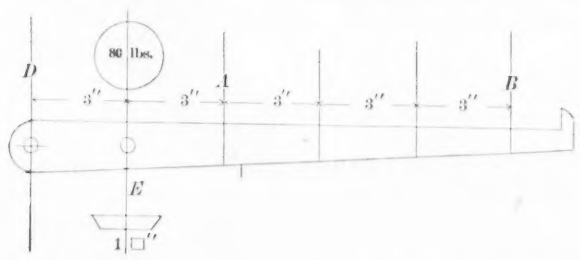
John Fish, M. E. Air Compressors and Working Drawings a specialty. Room 23, 10 Pine St., New York.

W. Barnet Le Van, Mechanical and Consulting Engineer, 3607 Baring Street, Philadelphia, Pa.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) J. B., Fishkill Landing, N. Y., writes: I have a safety valve of one square inch area; the ball weighs 80 lbs.; the weight of the valve and lever is 20 lbs. Will it or will it not take 100 lbs. pressure to raise the valve from its seat? If the ball is placed at *A*, what pressure will it take to raise it? Also, what pressure will it require to raise the valve from its seat if the ball be placed at *B*? Please give a sketch of the lever marked off, together with the weight of the ball, describing the details in the most simple way. Is it possible to weigh the lever and ball with the common platform scales? *A.*—You have neglected to give one of the most important factors for the calculation of the safety valve lever—viz., the center of gravity of the lever arm; nor do you give any dimensions, so that it can be calculated. Without knowing the center of gravity, it is plain that in this case it will take more than 100 lbs. per square inch to raise



the valve from its seat. If the weight of the lever valve and stem was added to the ball weight and then placed over the valve *E*, as shown in his sketch, it then would raise it from its seat at 100 lbs. pressure per square inch; but as the lever arm extends beyond the center of the valve, it will take more pressure per square inch. To illustrate it, we will assume that the center of gravity of the lever valve and stem to be at *A*, on his sketch, which is six inches from the fulcrum *D*, then the weight of lever valve and stem will correspond to a weight of 40 lbs. on the valve, and the ball of 80 lbs., placed directly over the valve, as per sketch, will require 120 lbs. per square inch to raise it from its seat.

$$\text{Pressure} = \frac{20 \text{ lbs.} \times 6}{1 \times 3} = 40 \text{ lbs.},$$

to raise the lever valve and stem, to which add the weight of the ball, 80 lbs., making 120 lbs. Assuming the center of gravity to be 6 inches from fulcrum, as above, by placing the ball at *A*, as per sketch, the valve will raise at

$$\text{Pressure} = \frac{80 \times 6 + 20 \times 6}{1 \times 3} = 200 \text{ lbs.}$$

And if the ball is placed at *B*,

$$\text{Pressure} = \frac{80 \times 15 + 20 \times 6}{1 \times 3} = 440 \text{ lbs.}$$

RULE.—Multiply the weight of ball in pounds by its distance from fulcrum, to which add the weight of lever, valve and stem, multiplied by its center of gravity, this being the distance from the fulcrum that the lever will balance over a sharp edge, with the valve and stem placed on the lever at its proper distance from the fulcrum—this sum being divided by the product of the area of the valve in square inches, and multiplied by its distance from fulcrum. A simple plan for finding the pressure a safety valve exerts on the valve is as follows: Place the safety valve in its working position, secure the valve and its stem to the lever arm at its proper distance from the fulcrum with wire or string, and attach a loop to the lever directly over the center of the valve. Then pass the hook of an accurate spring balance into this loop, take hold of the upper part of the spring balance, and lift the valve clear of its seat, and it will indicate the total pressure which the valve stem and lever tends to keep the valve in its seat, which pressure being divided by the number of square inches in the valve will give the pressure per square inch at which steam commences to blow off, due to the weight of lever arm, valve and stem. Placing the weight on lever arm at the point required, and proceeding as above, will give the steam pressure for any point the weight is placed. In the course of the articles on Safety Valves, by W. Barnet Le Van, now being published in THE AMERICAN MACHINIST, this subject will be more fully ventilated.

(2) G. V., New York, asks: Can you give me the receipt for giving to brass a dark blue color, the same as used on sextants and quadrants? *A.*—Polish the articles and dip them in aquafortis; rinse the acid off with clean water, and place it in the following mixture until it turns black: Hydrochloric acid, 12 lbs; sulphate of iron, 1 lb., and pure white arsenic, 1 lb. It must then be taken out, rinsed in clean water, dried in saw-dust, polished with black-lead, and then lacquered with green lacquer.

(3) A. M., Ottumwa, Iowa., asks: Has there ever been any experiments or other steps taken as to the practicability of using dirt as a fuel? *A.*—There have been extensive experiments tried for utilizing coal-dust for fuel. We suppose that by the term "dirt" you mean coal-dust, as in order to burn anything it must be impregnated with more or less combustible matter. We refer you to an article which was published in our issue of March 13, 1880, describing the manufacture of pressed fuel, written by E. F. Loiseau. This article will probably enlighten you on the subject.

(4) J. C. G., Marlboro, Mass., asks: Why do engine-builders use a composition box lined with babbitt metal for the boxes in connecting-rods? What is the objection to composition boxes? *A.*—In some cases it is a matter of taste; in others, and we may say the general object aimed at is to get a cheap, durable bearing, as a box made from cheap composition will not do for a high speed, consequently it is lined with babbitt or other soft metal. A composition box made of the best materials is by all means the most economical. We are acquainted with instances where it has been found necessary to abandon all soft metal lining in rod boxes and substitute bronze and the best composition. This was done by a Company owning about 500 engines. The only objection to a good composition box is the price.

(5) J. H., Brooklyn, N. Y., asks: Will you give the process of blueing steel by boiling or dipping, such as pins, watch-hands, and dish-covers? *A.*—We are not acquainted with any reliable process for producing a blue color upon steel by boiling. The usual process is to provide an iron box, and put into it a necessary amount of clean fine sand. Place the box over a fire, and raise the temperature of the sand which is required to produce the following colors—viz.: Very pale yellow, 430° Fahr.; straw yellow 460°; brown yellow, 500°; light purple, 530°; dark purple, 550°; clear blue, 570°; pale blue, 610°; blue tinged with green, 630°. The articles should be polished and placed in the sand, care being observed to watch them, so that when the right color appears quickly remove them.

MANUFACTURES.

The Betts Machine Co., Wilmington, Del., report demand for machinists' tools, gauges, etc., with advancing prices. To their already extensive works, they are now adding a new brick blacksmith shop.

Jennings & Co.'s West Bergen Steel Works at West Bergen, Hudson county, N. J., are being rapidly pushed to completion.

The Wiley & Russell Manufacturing Company, Greenfield, Mass., are doing an extensive business, and are full of orders for taps, dies, patent screw cutting, and other labor-saving machinery and tools.

Z. Chaffee, trustee of A. & W. Sprague Manufacturing Company, has advanced the wages of his employes at Natick, Mass., 10 per cent. This is the second raise within three months.

The Ames Manufacturing Company, Chicopee, Mass., are employing from 425 to 450 hands, are full of orders, and compelled to run overtime.

The Cuyahoga Works, of Cleveland, O., have just erected one of their new style of 84 inch blowing engines at the new furnace of the Mahoning Valley Iron Company at Youngstown. This is the fourth engine of the kind recently built by them, and they have three more nearly completed for the Union Iron and Steel Company of Chicago.

A large box manufactory is about to be built in St. Louis, by Messrs. Bower Bros. and C. Metzler, at a cost of four or five thousand dollars, and it is expected to be ready for operation by or before June 1st.

The Cairo Short Line Railroad Company have let the contract for building their new shops at East St. Louis, Ill.

There is unusual activity in all branches of the iron industry, says the St. Louis *Journal of Commerce*, but in none more than in the foundry and machine shops which are especially engaged in making elevators for stores, warehouses, granaries, etc., steam engines, presses and such like. Some prominent concerns in this city are running day and night, having employed extra workmen, and are yet behind hand in filling their orders.

The new Cleveland Crucible Steel Co. have completed their works and started up with several orders already booked.

The Otis Steel & Iron Co., Cleveland, O., have just received another steam helve hammer from the Cuyahoga Works of that City. This is the third and largest hammer the Cuyahoga Works have furnished them, the steam cylinder being 32 inches bore.

A. H. Blaisdell, Vineland, N. J., is running full time, and has plenty of orders. Mr. B. has recently taken control of the Schofield's Shafting Straightener, and is now ready to fill orders.

The Alliance Machine Co., of St. Louis, have reorganized under the name of the National Machine Co., with a capital of $30,000. They propose to manufacture a new calculating machine, also an adding machine, and board measure. F. S. Baldwin, the superintendent of the company, is the patentee of the above articles.

About May 1, the Clinton stove foundry, Troy, N. Y., will shut down for four or five weeks in order to substitute a new boiler and engine for the ones now in use. The foundry has been running steady since March, 1879. On account of the large number of orders there was no cessation of operations last fall.

Dwight Slate, 262 Main St., Hartford, Conn., writes us: While connected, as announced by you, with the E. Horton & Son Co., of Windsor Locks, Conn., as Mechanical Superintendent, please state that I shall continue my business of designing and constructing machinery in Hartford as formerly.

The Pioneer Works (limited) of Marcus Hook, Pa., of which Jos. Kidd is chairman; David Rose, sec.; Jas. A. Hargan, treasurer, and John Clay, General Manager, went formally into operation last week. They occupy a building that was formerly used as a sugar refinery, and recently as a machine shop by Keesey & Hubbel. The company is prepared to build all classes of small boats up to 150 feet in length, and various kinds of castings.

Says the Sharon *Herald*: The citizens of Hubbard, O., are taking action in the matter of having new steel works located in that vicinity. Offers are freely made of twenty acres of land, and if necessary to further secure it, a bonus in money will also be raised as an inducement to come there.

Indications are favorable for securing the manufacture of the Ludlow lock for Akron, O. Mr. John Stambaugh offered to Mr. Ludlow the old Homer Hamilton works and grounds at $7,000, to be taken in stock, and $5,000 of stock besides, making in all, a subscription of $12 000. Several well known citizens have intimated their willingness to take stock in the concern.

The Fulton Iron works of this city, says the St. Louis *Journal of Commerce*, are engaged in the construction of three cotton compresses, one of which is to be erected at Atlanta, Ga., and one at Columbus, Miss. The point at which the third one is to be placed the builders decline to state.

The Trade Watch Company of Chicago have applied for a charter of incorporation. Half the capital stock, $120,000, has already been subscribed. The factory is to be located at Rogers Park, a suburb about ten miles from the city on the Milwaukee division of the Northwestern Railroad. The land required has been donated by property owners in the vicinity, and the work of building will be commenced as soon as the weather will permit.

Machinists' and Engineers' Supplies.

New York, April 22, 1880.

The supply market is quiet this week, and more of the manufacturers are in the market for orders.

Buyers are holding off, expecting prices to fall still lower.

Iron pipe has gradually fallen from a discount of 5 and 5 per cent. to a discount of 25 per cent. on list. The demand is light.

Boiler tubes are quoted at 55 per cent. discount from list.

Machine bolts are subject to a discount varying from 40 per cent. to 50 per cent., depending upon the condition of the contracts of the manufacturers.

Nuts and washers are expected to go still lower.

The prices of brass and copper tubing are unchanged, with a slow demand.

At a meeting of brass manufacturers, held at the Metropolitan Hotel, New York, April 15, 1880, it was unanimously voted that the price of brass shall be list No. 21, less 20 per cent. discount.

The price of scrap remains unchanged.

A decline in the list prices of copper is soon expected.

H. S. Manning & Co., 111 Liberty Street, New York, have taken the agency for the large variety of Woodworking Machinery manufactured by the H. B. Smith Machine Company.

Iron Review.

New York, April 22, 1880.

Owing to the decline, buyers are standing off and are indisposed to buy until the market is more settled. This makes trade quiet, and it will remain so until sellers become more reconciled to the decline and less eager to sell. Pierson & Co., 24 Broadway, New York, quote prices about the same as last week, except Ulster Iron, which has declined to 4.2 cents a pound.

Carmichael & Emmens, 130 Cedar Street, New York, report Boiler Makers' Supplies without change.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of April 22, 1880:

Metals still neglected, and prices not strong. London quotes Pig Tin, about £81; Singapore, about $26¼. This market merely nominal. Banca, 23c. Malacca & Straits, 20c.; Billiton, Australian and Refined, 19½c. to 20c.; "Lamb & Flag," 19¾c.; Pig Lead, 5¾c.; Antimony, 19c. to 24c., as to brands. Spelter, 6½c. for Foreign. Large lots of Domestic could be had at a concession. Ingot Copper, 21½c.; Nickel, $1.25; No. 1. Solder, 11c.; "Half-and-half," 13½c.

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Wanted—Ten first-class moulders. Address Holyoke Machine Co., Holyoke, Mass.

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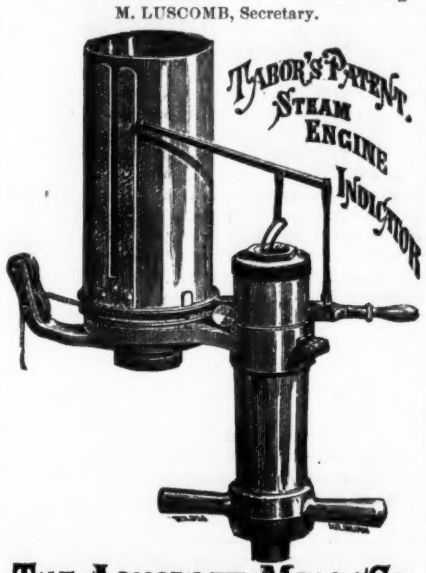

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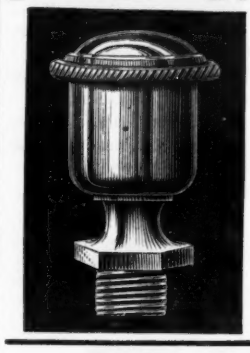

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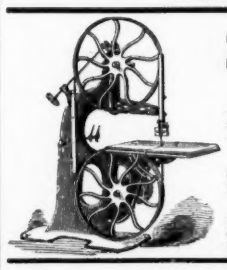

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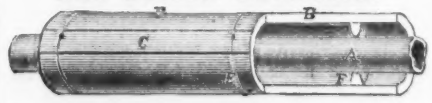

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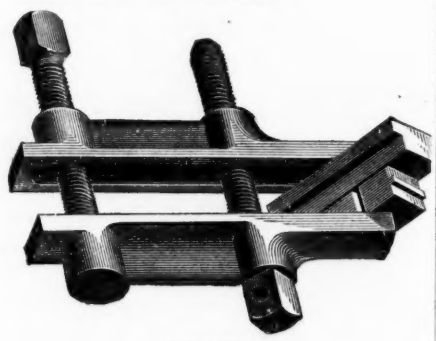

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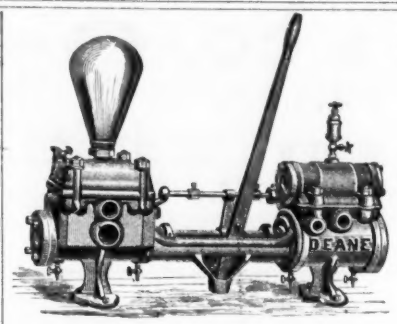

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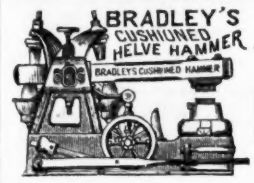

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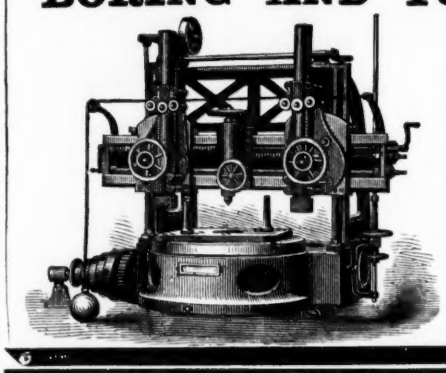

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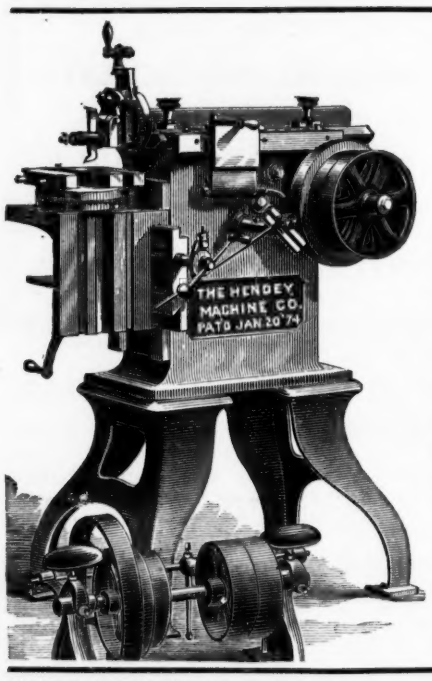

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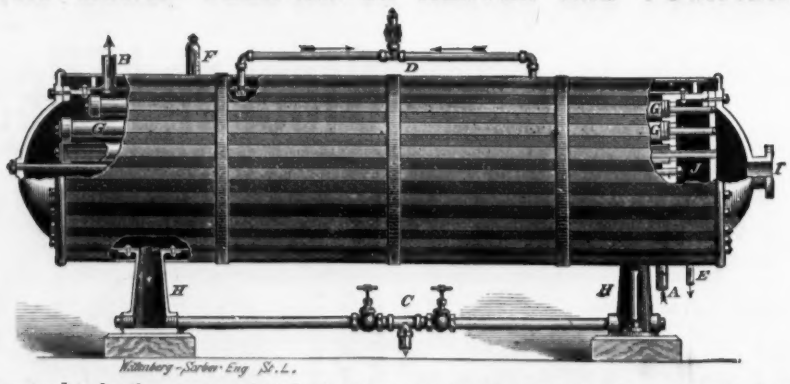

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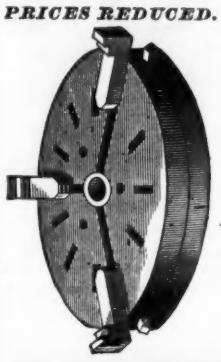

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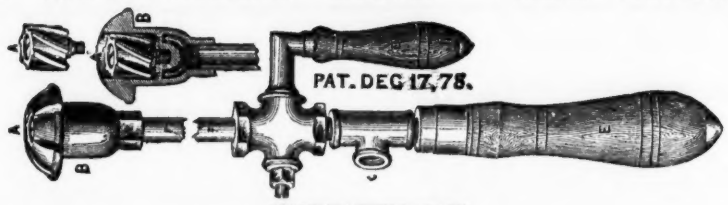

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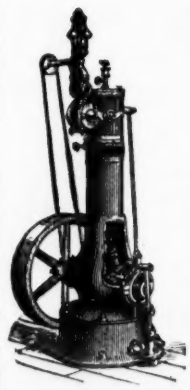

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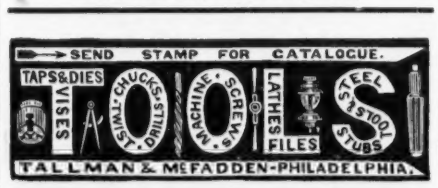

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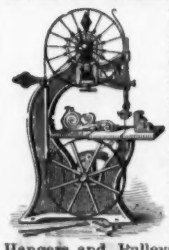

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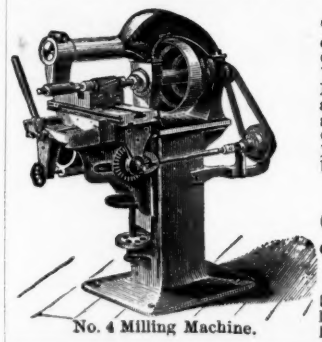

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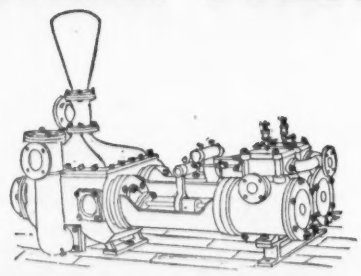

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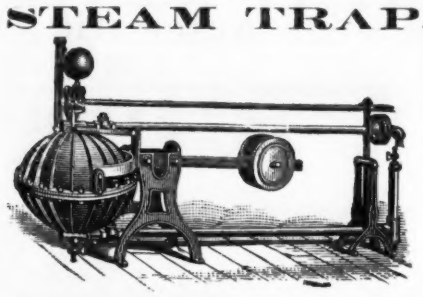

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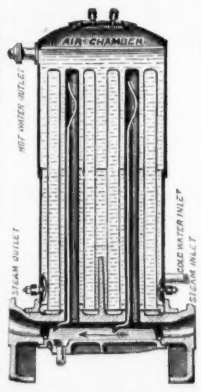

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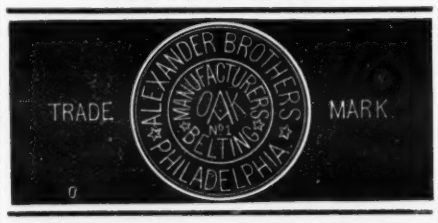

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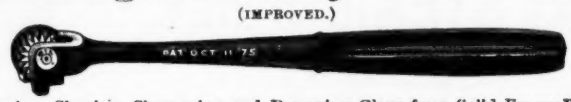

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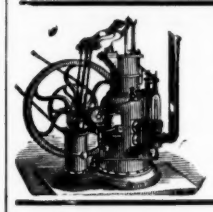

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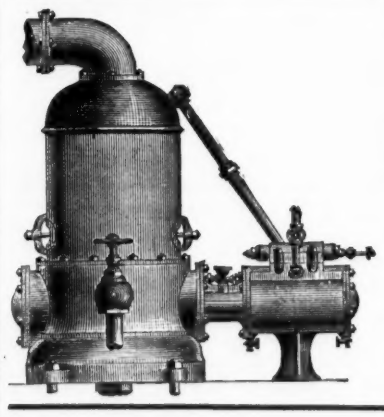

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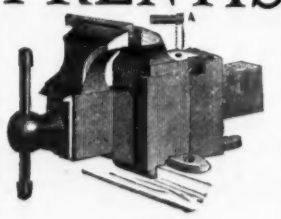

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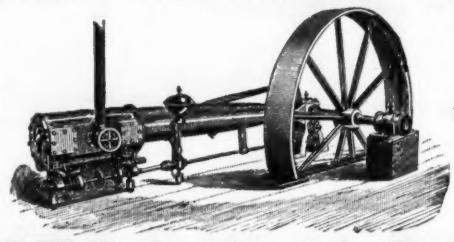

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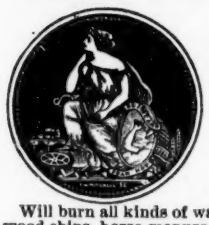

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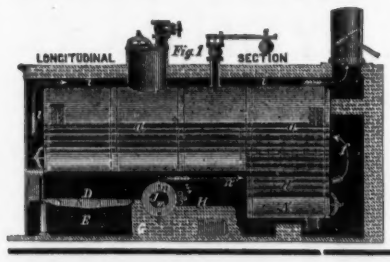

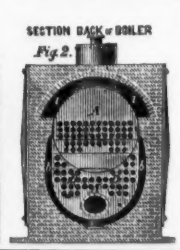

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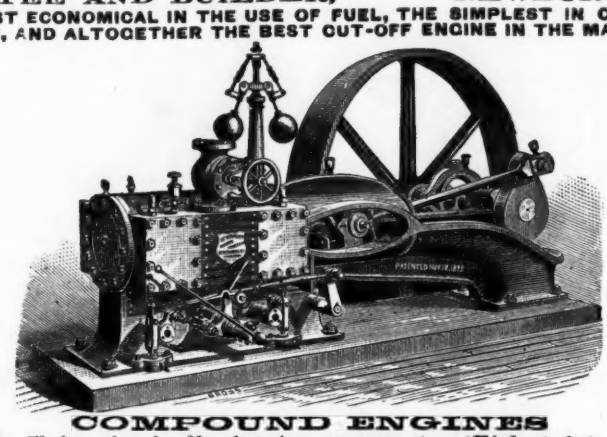

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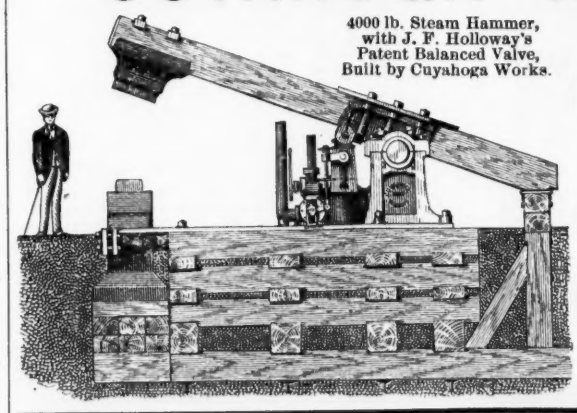

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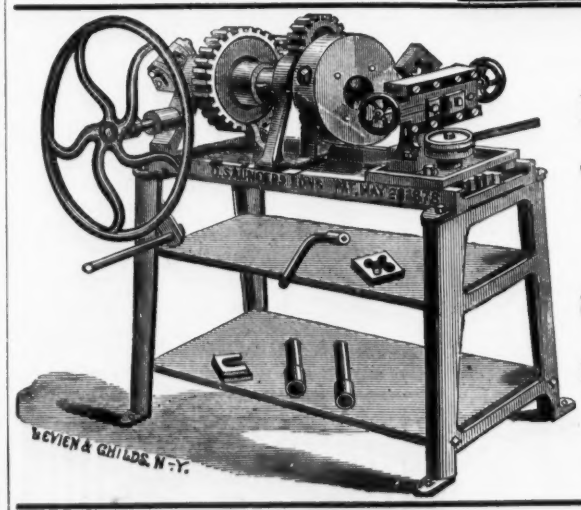

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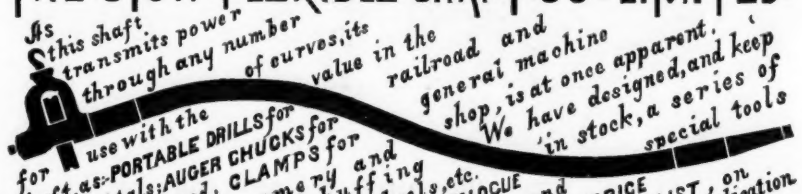

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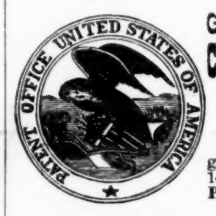

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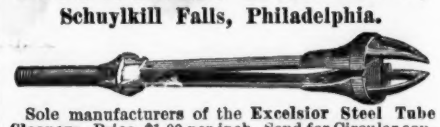

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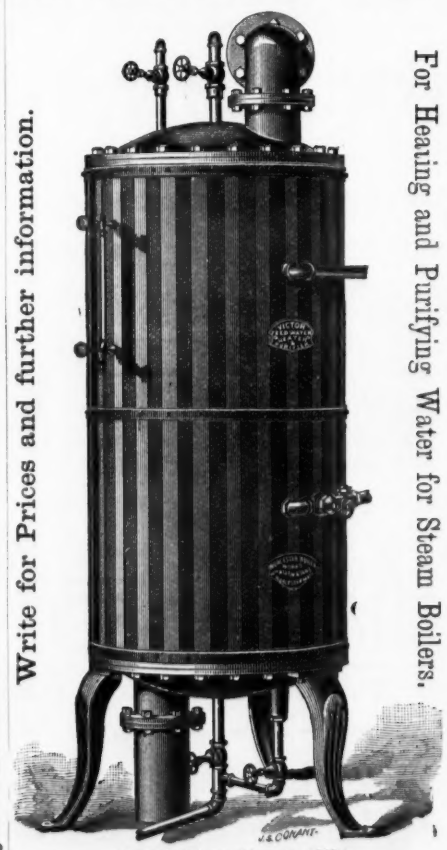

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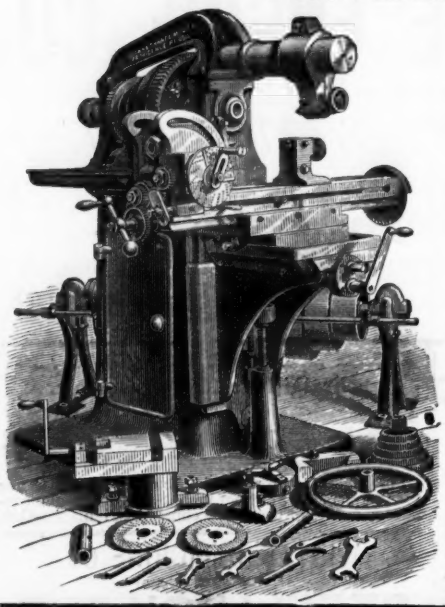

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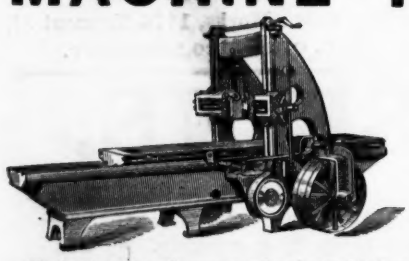

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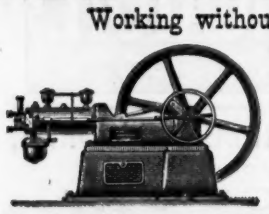

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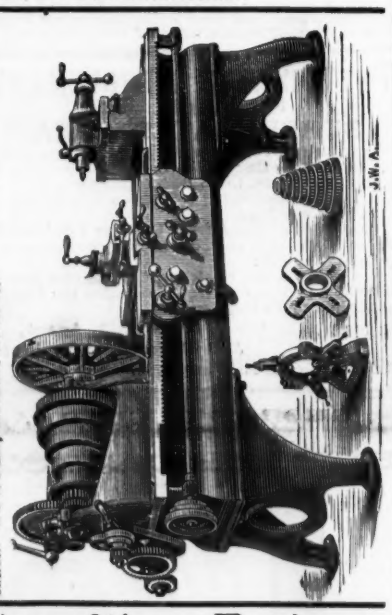

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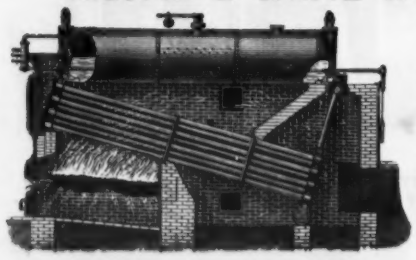

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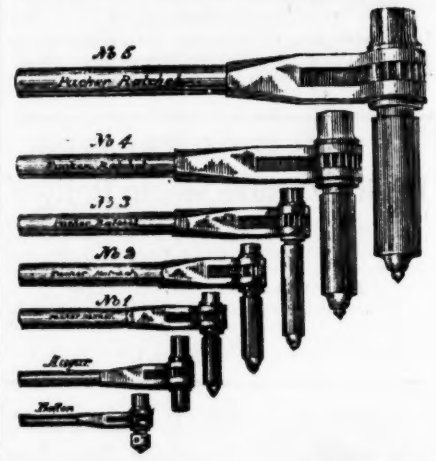

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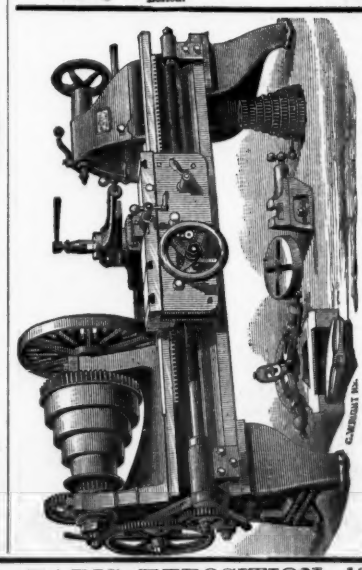

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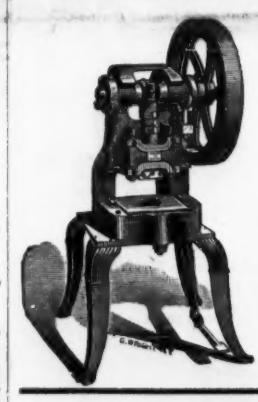

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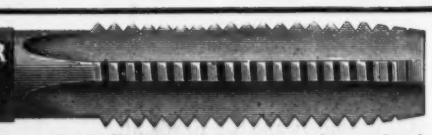

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